PB87-190039

Superfund Record of Decision (EPA Region 6) United Creosoting Company, Hilbig Road, Conroe, Texas

(U.S.) Environmental Protection Agency
Washington, DC

30 Sep 86

U.S. Department of Commerce
National Technical Information Service
NTIS

PB87-190039

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R06-86/014
September 1986

EPA

Superfund Record of Decision:

United Creosoting , TX

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12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460	13. TYPE OF REPORT AND PERIOD COVERED Final ROD Report 14. SPONSORING AGENCY CODE 800/00
15. SUPPLEMENTARY NOTES	

16. ABSTRACT

The United Creosoting site is a 100-acre tract of land located in the City of Conroe, Montgomery County, Texas. The site is an abandoned wood preserving facility over which two new businesses and a residential subdivision have been built. The site operated from 1946 to 1972, treating wood with creosote and pentachlorophenol (PCP). Prior to salvage and removal operations in 1972, the site contained a coal-tar distillation still, a processing building, tanks and pressure cylinders, two waste ponds, and several areas where treated lumber was stored. The only remaining evidence of the operation are remnants of the waste ponds, an office building and a garage structure. During the summer of 1980, Montgomery County obtained soils from the United Creosoting site to be used in improving local roads in a nearby subdivision. Soil material consisted of surface soils and pond backfill from the Clark Distributing Company property. Citizens living on one of the "improved" streets complained of headaches, burns, respiratory problems and damage to vegetation. Samples indicated that soils were contaminated with PCP in concentrations up to 20.3 mg/l. Montgomery County officials removed the contaminated soils from the affected roadways and disposed of them by landfarming. In early December 1983, EPA initiated an Immediate Response Action at United Creosoting, taking over 25 soil samples. Samples indicated the presence of PCP, chlorinated dioxins (no tetrachlorinated dioxins), and dibenzofurans. EPA ordered Clark Distributing to
(See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field Group
Record of Decision United Creosoting Site, TX Contaminated Media: soil, ground water Key contaminants: PCP, PAHs, creosote		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report) None	21. NO. OF PAGES 68
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16. ABSTRACT (continued)

undertake an Immediate Response Action within the area of the former waste ponds. Work began in November 1983 and consisted of regrading exposed contaminated soils to divert surface water drainage away from the subdivision, capping contaminated soils with a synthetic membrane cap and 6 inches of compacted clay, fencing the capped area, and constructing drainage ditches to channel cap area runoff to the south of the Clark property (vacant land). Work on this activity was completed in April 1984, and the RI/FS for the whole site area was begun in December of 1984.

The selected remedial action for the site includes: purchase and demolish six homes located directly above and adjacent to the former pond area; conduct permanent relocations of the persons currently residing in these homes; consolidate surface soils contaminated with greater than 100 ppm of polynuclear aromatic hydrocarbons (PAHs) and surface soils which are visibly contaminated onto the former waste pond area; construct a temporary cap over consolidated soils; periodically evaluate the availability of offsite disposal facilities and emerging alternative technologies; excavate and dispose of the soils contaminated with greater than 100 ppm of PAHs in the former pond area and in the former storage tank area when an appropriate facility or innovative technology becomes available; backfill excavated areas and restore ground surface with an appropriate cover; and allow ground water attenuation through natural processes of dilution and adsorption. The estimated capital costs of the remedy range from $4.5 million for future offsite land disposal to $140 million for offsite incineration. Factors such as site preparation, material and energy requirements, and disposal requirements must be evaluated before a cost estimate can be developed. Annual O&M costs are expected to be $43,000 during the interim closure period.

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

Site: United Creosoting Company, Hilbig Road, Conroe, Texas

DOCUMENTS REVIEWED

I have reviewed the following documents describing the analysis of the cost-effectiveness of the remedial alternatives for the United Creosoting Company site:

- Site investigation, United Creosoting Company, Roy F. Weston, Inc., December 1985.
- Feasibility Study, United Creosoting Company, Roy F. Weston, Inc., May 1986.
- Summary of Remedial Alternative Selection, United Creosoting Company, September 1986.
- Responsiveness Summary, September 1986.
- Staff summaries and recommendations.

DESCRIPTION OF SELECTED REMEDY

- Purchase and demolish six houses located directly above and adjacent to the former pond area.
- Conduct permanent relocations of the persons currently residing in these houses.
- Consolidate surface soils contaminated with greater than 100 ppm of polynuclear aromatic hydrocarbons and surface soils which are visibly stained onto the former waste pond area.
- Construct a temporary cap over consolidated soils.
- Periodically evaluate the availability of offsite disposal facilities and emerging alternate technologies.
- Excavate and dispose of the soils contaminated with greater than 100 ppm of PAHs in the former pond area and in the former storage tank area when an appropriate facility or innovative technology becomes available.
- Backfill excavated areas and restore ground surface with an appropriate cover.
- Groundwater attenuation through natural processes of dilution and adsorption.

DECLARATION

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the National Contingency Plan (40 CFR Part 300), I have determined that the selected alternative for the United Creosoting Company site is a cost-effective remedy and provides adequate protection of public health, welfare, and the environment. The State of Texas has been consulted and agrees with the approved remedy. In addition, the action will require future operation and maintenance activities to ensure the continued effectiveness of the remedy. These activities are considered part of the approved action, and eligible for Trust Fund monies for a period up to one year. I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies for use at other sites.

9/30/86
Date

for Frances E. Phillips
Acting Regional Administrator

Summary of Remedial Alternative Selection
United Creosoting Company
Conroe, Texas

BACKGROUND

The United Creosoting Company site is an abandoned wood preserving facility over which two new businesses and a residential subdivision have been built. Formed lumber, such as telephone poles and railroad ties, were treated by the pressurized addition of creosote and pentachlorophenol (PCP). The site was abandoned in 1972. The only remaining evidence of the former wood preserving operations are the remnants of two waste ponds, an office building, and a garage structure.

Site Location and Description

The United Creosoting Company site is a 100 acre tract located in the City of Conroe, Montgomery County, Texas (Figure 1). The site is 1/4 mile southwest of the intersection of Loop 336 and the Missouri-Pacific Railroad. The United Creosoting Company property is bound on the west and south by Alligator Creek, on the north by Dolores Street and on the east by the Missouri-Pacific rail lines. The site is now occupied by the Clarke Distributing Company, Conroe Construction Company, and the Tanglewood East subdivision (Figure 2).

The physical characteristics of the site have been locally altered by the redevelopment of the property, which has resulted in residential and light industrial structures typical of suburban northern Conroe. Other residential areas surround the site to the immediate north, west and south, while industrial and commercial land uses are evident to the east.

Approximately 13,000 people currently live within a 2-mile radius of the site, and rapid population gains are expected to continue in Conroe through the year 2000.

SITE HISTORY

The United Creosoting Company operated from 1946 to 1972. The wood preserving plant site, prior to salvage and removal operations, contained a coal-tar distillation still, a processing building, tanks and pressure cylinders, two waste ponds, and several areas where treated lumber was stored. Figure 3 depicts the estimated location of the processing facilities based on a review of historical aerial photographs. The two waste ponds were used by United Creosoting for disposal and possible reclamation of wood preserving process wastes.

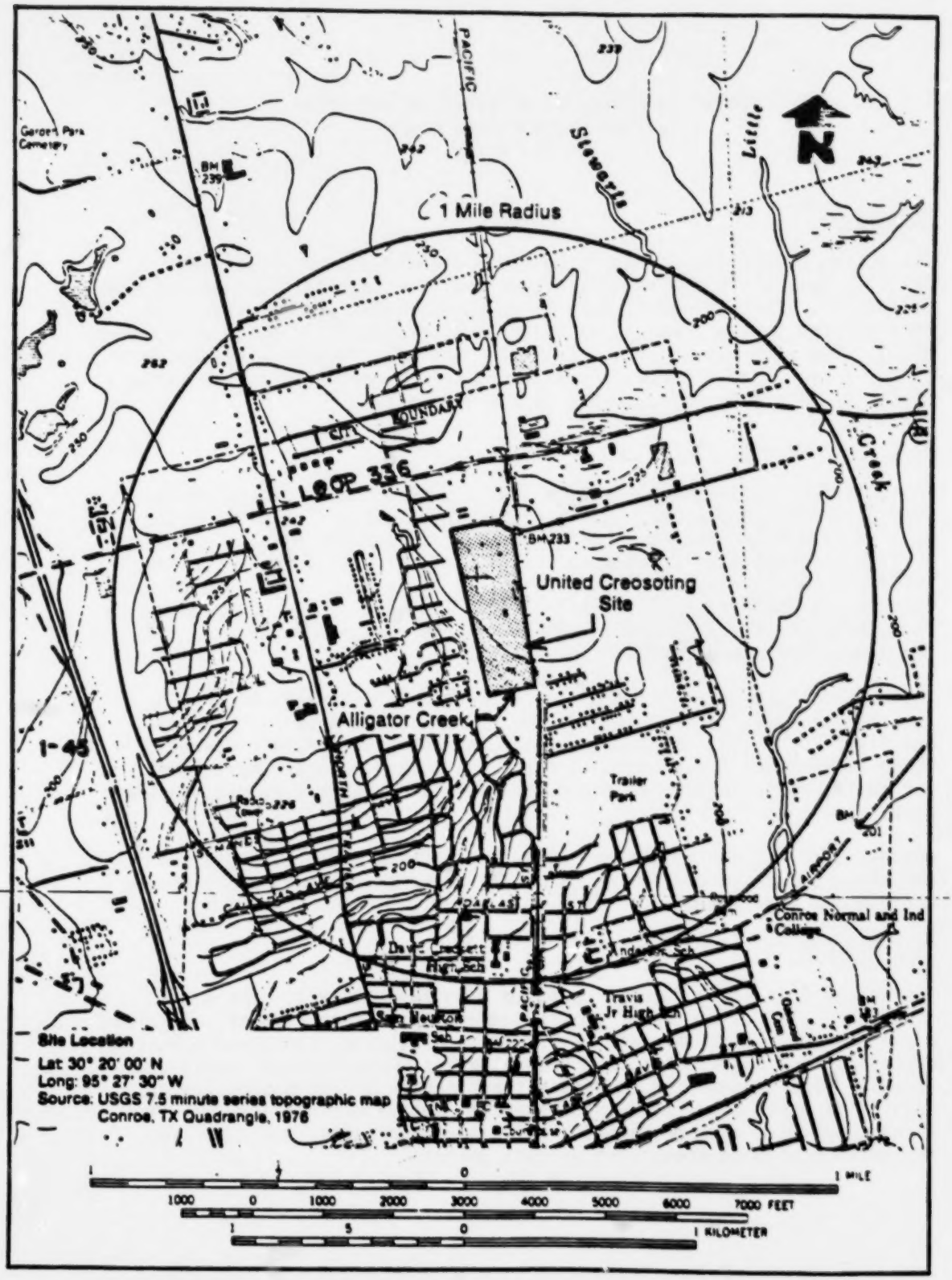
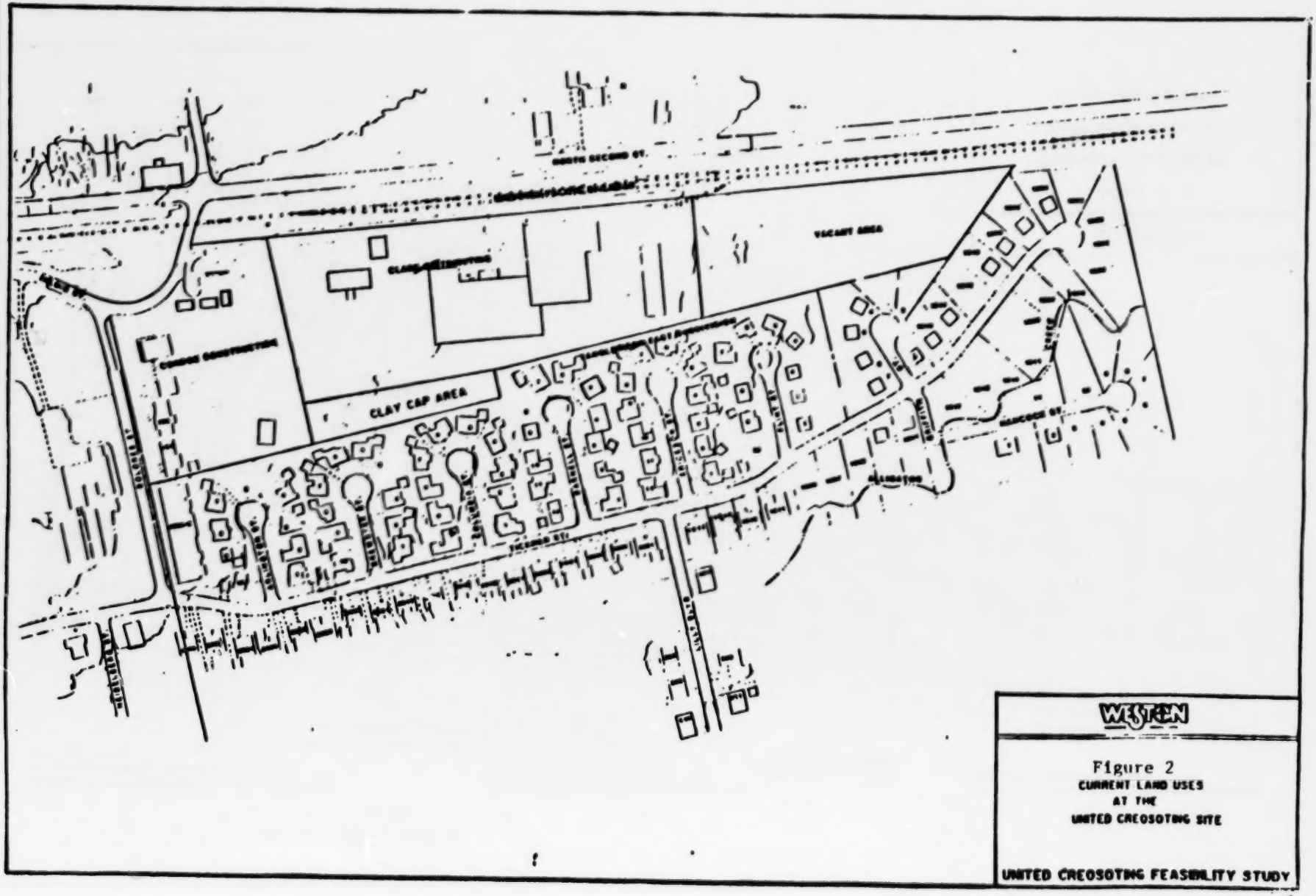
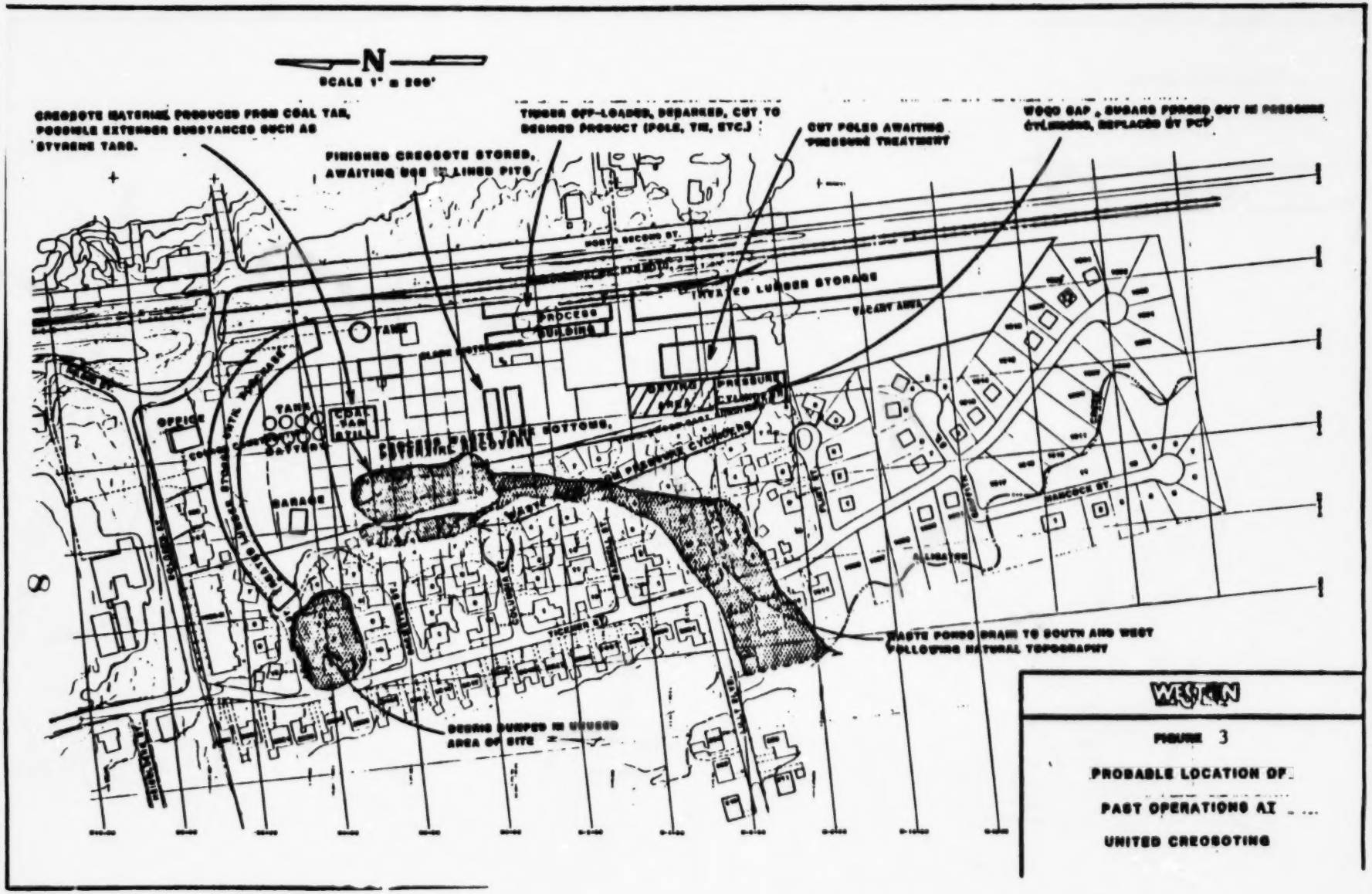


FIGURE 1 LOCATION MAP OF UNITED CREOSOTING


CLAY CAP AREA
VACANT AREA
WESTERN
Figure 2
CURRENT LAND USES
AT THE
UNITED CREOSOTING SITE
UNITED CREOSOTING FEASIBILITY STUDY


N
SCALE 1" = 200'
CREOSOTE MATERIAL PRODUCED FROM COAL TAR, POSSIBLE EXTENDER SUBSTANCES SUCH AS STYRENE TARS.
FINISHED CREOSOTE STORED, AWAITING USE IN LINED PITS
TIMBER OFF-LOADED, DEBARKED, CUT TO DESIRED PRODUCT (POLE, TIE, ETC.)
CUT POLES AWAITING PRESSURE TREATMENT
WOOD GAP, SUGARS FORCED OUT IN PRESSURE CYLINDERS, REPLACED BY PCP
NORTH SECOND ST.
INVALCO LUMBER STORAGE
PROCESS BUILDING
TANK
OFFICE
TANK
COAL TAR PITS
GARAGE
WASTE
HANCOCK ST.
WASTE POND DRAIN TO SOUTH AND WEST FOLLOWING NATURAL TOPOGRAPHY
DEBRIS DUMPED IN UNUSED AREA OF SITE
WESTON
FIGURE 3
PROBABLE LOCATION OF
PAST OPERATIONS AT
UNITED CREOSOTING

The United Creosoting site has been the subject of continuous investigation in recent years. In February 1970, the Texas Department of Water Resources (TDWR) conducted a site investigation of United Creosoting and found no discharge of wastewater from the site. In 1977, TDWR inspected the site and reported that the former waste ponds were being backfilled. Redevelopment of the site had begun at this time.

During the summer of 1980, Montgomery County obtained soils from the United Creosoting site for improvements to Metts Road, Mockingbird Lane, and various roads in the Lake Conroe Forest Subdivision. These soils consisted of surface soils and pond backfill from the Clarke Distributing property. Citizens living along Metts Road complained of headaches, burns, respiratory problems, and damage to vegetation. Samples were collected from the roads and several locations on the Clark Distributing Company property. Analysis of leachate from these soils indicated pentachlorophenol concentrations up to 20.3 mg/l. Montgomery County officials removed the contaminated soils from the affected roadways and disposed of the soils by landfarm treatment.

In August 1982, TDWR installed three monitoring wells on site. Additional wells were installed by the EPA Region VI Field Investigation Team (FIT) and the National Center for Groundwater Research (NCGR) in 1982 and 1983. Analytical results of samples taken from these wells indicate that polynuclear aromatic hydrocarbons and pentachlorophenol contamination was present in the uppermost water bearing zone.

TDWR submitted the United Creosoting site as a candidate for cleanup under the Superfund program in August 1982. The immediate concern at that time was contaminated surface water runoff flowing from the former waste ponds area into Tanglewood East Subdivision. The TDWR collected additional soil, water and air samples from the site during the remainder of 1982 and into early 1983. In September 1983 the United Creosoting site was included on the proposed NPL by EPA and thus became eligible for remedial funding.

In early December 1983, EPA initiated an immediate response action at United Creosoting. Twenty-five surficial soils samples were taken in the vicinity of the former waste ponds and within the Tanglewood East subdivision. The soils were found to be contaminated with pentachlorophenol and chlorinated dioxins and dibenzofurans. No tetrachlorinated dioxins were identified at the site. It was suspected that the source of the contamination might be storm water runoff from former waste pond areas located on Clarke Distributing property.

Based on the sampling results, Clark Distributing was directed under the terms of an EPA Administrative Order on Consent to undertake an immediate response action within the area of the former waste ponds. The action regraded exposed sections of contaminated soils so that surface water drainage was diverted away from the subdivision, capped areas of contaminated soil with a synthetic membrane and at least 6 inches of compacted clay, restricted access to the cap area by the addition of 200 feet of fence, and constructed drainage ditches to channel cap area runoff to the south through Clarke-owned vacant land. The action began in November 1983 and was completed in April 1984.

A Cooperative Agreement for a Remedial Investigation and Feasibility Study (RI/FS) was awarded to the State of Texas in March 1984. Roy F. Weston, Inc., was contracted to conduct the RI/FS. Field work for the RI was conducted in two phases, the first in December 1984 and the second in August 1985. The data generated was used to estimate the extent and magnitude of contamination and to evaluate the alternatives developed in the feasibilty study. The total cost of the project to date has been approximately $1.1 million.

CURRENT SITE STATUS

The United Creosoting Company site investigation consisted of surficial soil sampling, soil borings, lagoon borings, trenching, groundwater sampling, sediment sampling, stormwater/surface water sampling, and air monitoring. A geophysical survey was used to better define the location and volume of the former waste ponds. The investigation focused on the identification of the geologic and hydrologic characteristics of the site, the extent and magnitude of contamination from the site, the target receptors, and population at risk.

Regional Geology and Surface Soils

The United Creosoting Company site is geologically situated in the West Gulf Coastal Plain physiographic province of Texas. The coastal plain is generally characterized by flat to gently rolling uplands with mud and sand substrata. In the vicinity of the site, the topography comprises gently rolling uplands and the natural vegetation consists of forest.

Regional soils maps prepared by the USDA Soil Conservation Service indicate that the natural soils in the area consist of the Conroe Association. Specifically, the natural soils at the site consist of the Conroe and Splendora series. These soils range from gravelly loam to loamy fine sand of nearly level to 5-percent slopes. The soils have

moderate available water capacity. As a result of industrial and residential development, much of the natural soils in the vicinity of the site have been disturbed or covered by fill material and various structures.

A generalized geologic map of Montgomery County is presented in Figure 4. As shown, the site is underlain by unconsolidated sediments (sand, gravels, and clay) in alluvial fan deposits. These deposits are of Pleistocene Age (3 million to 20 thousand years old), and were formed by high-gradient braided streams that flowed coastward from uplands to the north.

Stratigraphic information relative to the coastal plain of Texas is presented in Table 1. Alluvium, the Beaumont Clay, the Montgomery Formation and the Bentley Formation are not found at the United Creosoting Company site. The surficial sediments at the site belong to the Willis Sand (Formation), the coarsest of the Pleistocene Formations.

The Willis Formation consists largely of clayey sand and gravel and some localized clay beds. The gravel is fairly coarse, is uniformly sandy, and contains much fossilized or petrified wood. The Willis Formation dips toward the Gulf at about 10 feet per mile and, in the vicinity of the site, is estimated to be approximately 70 feet thick. The approximate elevation of the top of the Willis Formation at the United Creosoting Company site is 230 feet MSL.

Underlying the Willis Formation are the Goliad Sand (Pliocene Age), Fleming Formation (Miocene Age), Catahoula Sandstone (Miocene Age) and the Jackson Group (sandstone and clay members of the Eocene Age). The thickness of these sediments above the top of the Jackson Group is approximately 3,600 feet in the vicinity of the site.

Regional Hydrogeology

Groundwater is the major source of public and industrial water supplies in Montgomery County, Texas. Three aquifers furnish the groundwater used in the County. In order of increasing depth these aquifers are: the Chicot Aquifer, the Evangeline Aquifer, and the upper part of the Jasper Aquifer. The Burkeville Aquiclude, a massive clay layer, hydraulically separates the upper part of the Jasper Aquifer from the Evangeline. The majority of the groundwater is pumped from the Evangeline and upper Jasper Aquifers. Lesser amounts of groundwater are pumped from several low volume wells present in the Chicot Aquifer in Montgomery County, some of which are in the immediate vicinity in the United Creosoting site.

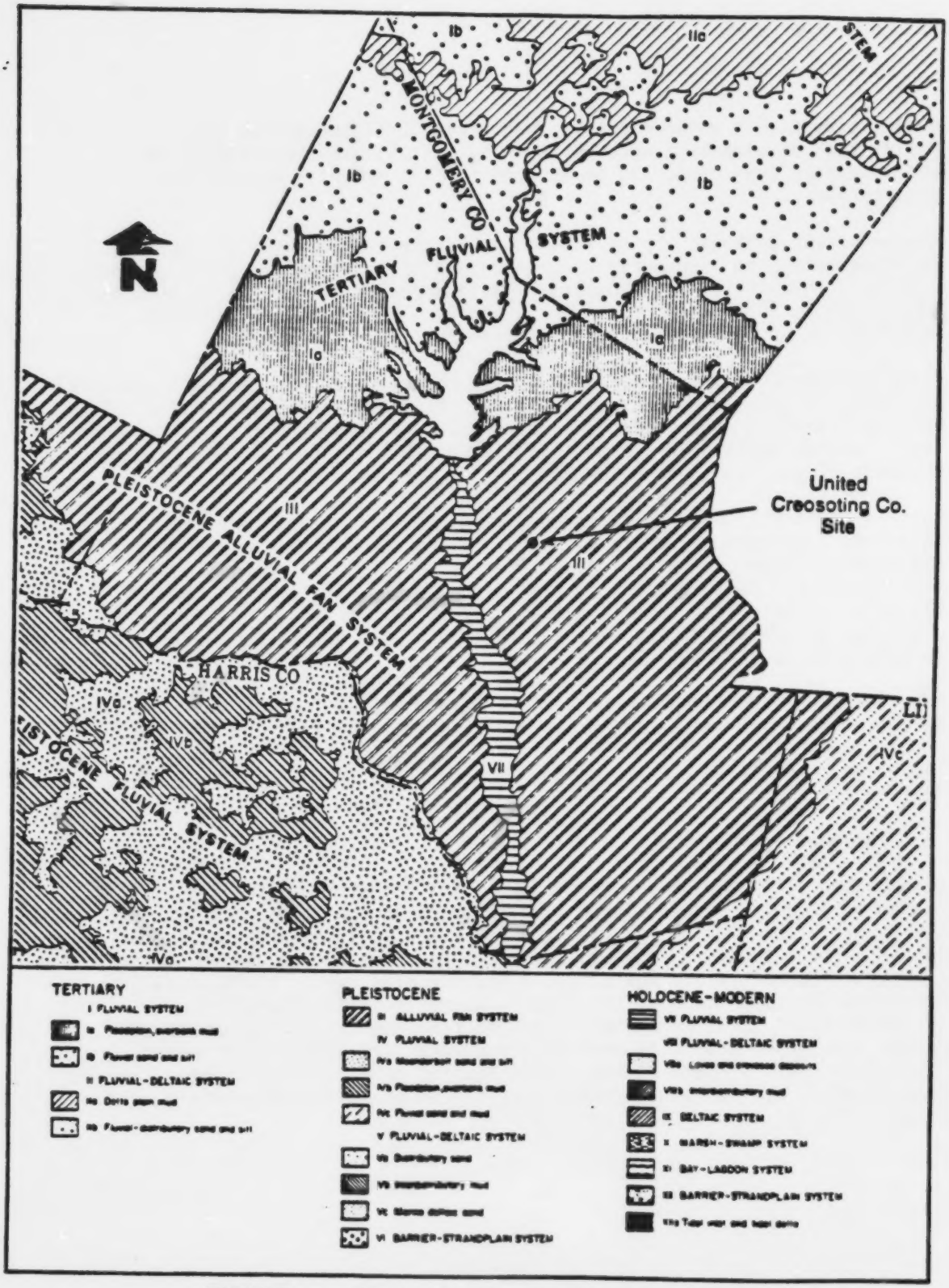


FIGURE 4 GENERALIZED GEOLOGIC MAP FOR MONTGOMERY COUNTY, TEXAS

Table 1

Stratigraphic and Hydrogeologic Framework of Part of the Coastal Plain of Texas

Era	System	Series	Stratigraphic Units	Hydrogeologic Units	Selected Faunal Markers	Remarks
CENOZOIC	Quaternary	Holocene	Alluvium	Chicot aquifer		Quaternary System undifferentiated on sections.
		Pleistocene	Beaumont Clay Montgomery Formation Bentley Formation Willis Sand			
	Tertiary	Pliocene	Goliad Sand	Evangeline aquifer		Goliad Sand overlapped east of Lavaca County.
		Miocene	Fleming Formation	Burkeville confining system	*Potamides matsoni* *Bigenerina nodosaria* var. *directa* *Bigenerina humblei* *Amphistegina* sp	
			Oakville Sandstone	Jasper aquifer		Oakville Sandstone included in Fleming Formation east of Washington County.
			Catahoula Tuff or Sandstone (Subsurface: Upper part of Catahoula Tuff or Sandstone; Anahuac Formation; "Frio" Formation)	Catahoula confining system (restricted)	*Discorbis mamala* *Discorbis gravelli* *Heterostegina* sp *Marginulina idiomorpha* *Textularia mississippiensis*	Catahoula Tuff designated as Catahoula Sandstone east of Lavaca County. Anahuac and "Frio" Formations may be Oligocene in age.
		Oligocene(?)	Surface: Frio Clay; Subsurface: Vicksburg Group equivalent	Not discussed as hydrologic units in this report.	*Textularia warreni*	Frio Clay overlapped or not recognized on surface east of Live Oak County.
		Eocene	Jackson Group: Whitsett Formation (Fashing Clay Member; Calliham Sandstone Member or Tordilla Sandstone Member; Dubose Member; Dewesville Sandstone Member; Conquista Clay Member; Dilworth Sandstone Member); Manning Clay; Wellborn Sandstone; Caddell Formation		*Marginulina carmanis* *Textularia buckleyensis* *Marginulina pratti* *Textularia dibollensis*	Indicated members of Whitsett Formation apply to south-central Texas. Whitsett Formation east of Karnes County may be, in part or in whole, Oligocene in age.
			Claiborne Group: Yegua Formation; Cook Mountain Formation; Sparta Sand; Weches Formation; Queen City Sand; Reklaw Formation; Carrizo Sand		*Nonionella cockfieldensis* *Discorbis yeguaensis* *Epanomalus yeguaensis* *Cristellaria evansi*	
		Paleocene	Wilcox Group Midway Group			

The sands of the Evangeline and Chicot Aquifers and the upper 300 feet of the Jasper Aquifer contain fresh water in the Conroe area. Lower sands of the Jasper Aquifer contain saline waters. Figure 5 illustrates the occurrence and thickness of the aquifers. These aquifers, as well as the Burkeville Aquiclude beneath the Evangeline, are described below:

- Chicot Aquifer - The Chicot is the youngest aquifer in the coastal plain of Texas and is continuous in the southern part of Montgomery County. These formations are composed of unconsolidated reddish sands and gravels, often ferruginous. In the Conroe area, the aquifer consists of the Willis Sand. Water from the Chicot is generally soft and fresh. The pH ranges from 5.0 to 7.5 and the concentration of dissolved solids ranges from 36 to 268 mg/L. The average permeability of the Chicot Aquifer in Montgomery County approaches that of the Aquifer in Harris County, which is 500 gallons per day (gpd) per square foot. Based on this permeability value the average transmissivity of the aquifer is estimated to be 25,000 gpd per foot.

  Water levels in the Chicot Aquifer fluctuate in response to recharge from precipitation and unlike the deeper aquifers, the water levels have not exhibited any long-term decreasing trend. The flow gradient in the aquifer is generally southward at a hydraulic gradient of approximately 4 feet per mile.

- Evangeline Aquifer - The Evangeline Aquifer is the major source of water in Montgomery County characterized by a sequence of alternating sands and clays of the Goliad Sand and part of the Fleming Formation above the Burkeville Aquiclude. Analyses of water from wells in the Evangeline indicate that water in this unit is generally fresh and hard. Dissolved solids concentrations range from 250 to 400 mg/L. The pH of the water ranges from 5.5 to 8.2.

  It is estimated that the average permeability of the Evangeline Aquifer in Montgomery County is 250 gpd per square foot, and the estimate of average transmissivity is 50,000 gpd per foot. Due to increased withdrawals over the past decade water levels have declined in wells completed in the Evangeline Aquifer by as much as 10 to 25 feet in the Conroe area. The groundwater flow direction in the Evangeline is generally southward at a gradient of approximately 5 feet per mile.

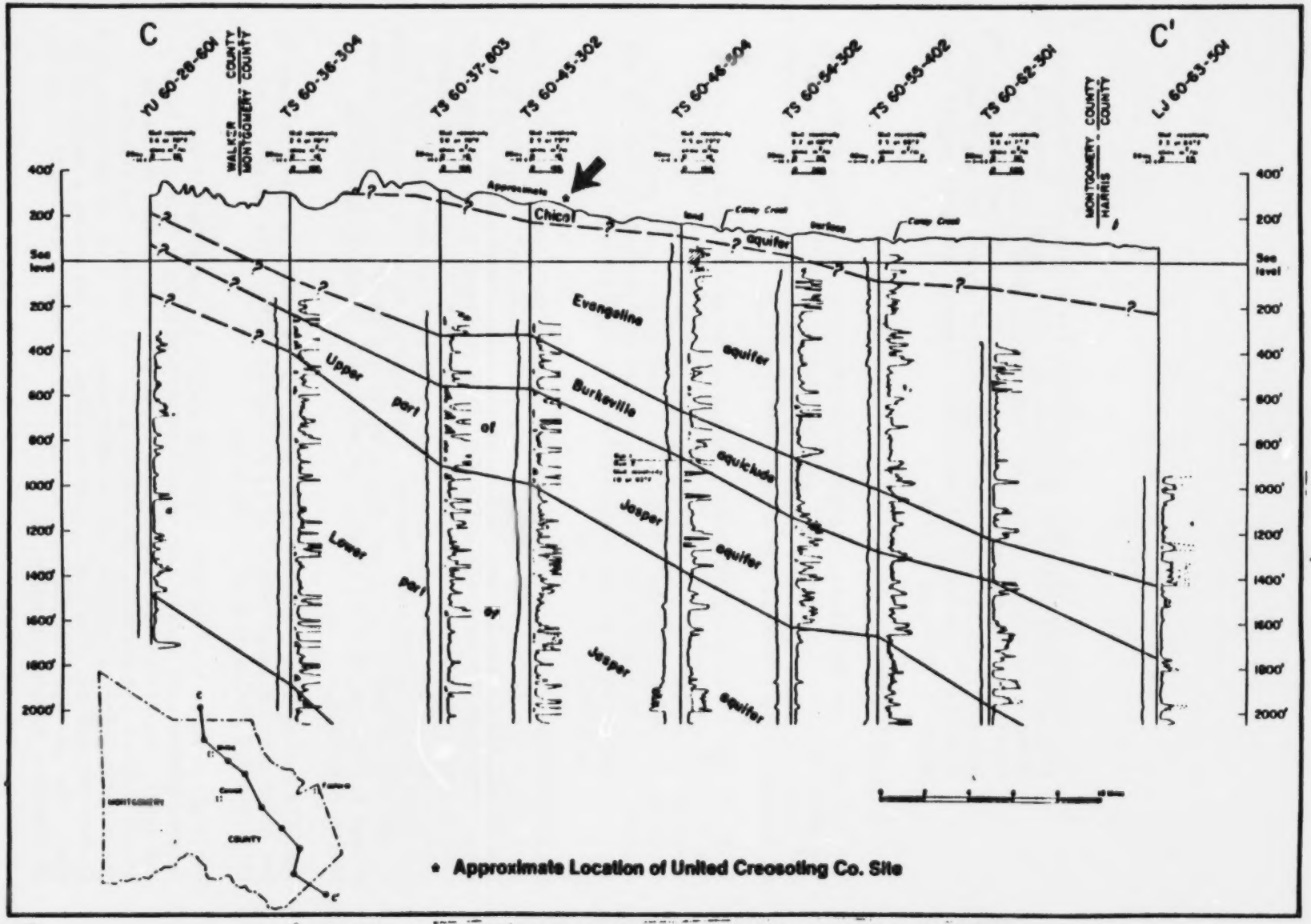


FIGURE 5 STRATIGRAPHIC AND HYDROGEOLOGIC SECTION MONTGOMERY COUNTY, TEXAS

- o The Burkeville Aquiclude - The Burkeville Aquiclude is a massive clay with thin interbeds of sands and silty sands. This unit forms a low permeability confining system which separates the Evangeline Aquifer from the upper part of the Jasper Aquifer. The Burkeville is not a source of groundwater except for small wells developed in a few areas where the interbeds of sands supply fresh water in small quantities.

Site Hydrogeology

The following hydrogeologic information on the United Creosoting site and the immediate area has been compiled from records of existing area wells and localized subsurface data gathered during remedial investigation activities of December 1984 (Phase 1) and August 1985 (Phase 2).

Drilling logs of selected Montgomery County water wells registered with the Texas Water Commission were reviewed in detail in order to identify those wells possibly impacted by the United Creosoting site. The wells reviewed are located in the TWC well-numbering system 2-1/2 minute quadrangles TS-60-45-4 and TS-60-45-5. These quadrangles contain the site and any reported wells which may be installed in downgradient strata within 2 miles of the site.

Data from these records show frequent use of both the Evangeline and Chicot aquifers in the Conroe area. At least 60 wells have been reported within the Chicot and Evangeline aquifers up to two miles downgradient from the site. The locations of these wells are shown in Figure 6. It is possible that a greater number of groundwater wells are installed within two miles downgradient of the site, and that these wells have not been reported to the Texas Water Commission. However, high volume, multiple user wells such as the City of Conroe municipal supply wells are generally screened in the deeper Evangeline sand and single-user wells are found in the shallow Chicot formation.

The site hydrogeology, schematically shown in Figure 7, is characterized by two water bearing zones separated by a clay aquitard. The thickness of this aquitard ranges from 22 to 32 feet.

The shallow water bearing zone ("25-foot sand") is comprised of two interconnected sand lenses separated intermittently by a thin clay layer. The upper, unconfined lens begins at a depth of 14 to 44 feet below the ground surface and averages approximately 10 feet thick. The average groundwater velocity in this lens is estimated to be 5 to 10 feet/year in a southern direction. The lower, semi-confined lens begins at a depth of 26 feet. The average groundwater velocity in this lens is estimated to be 5-15 feet/year toward the south.

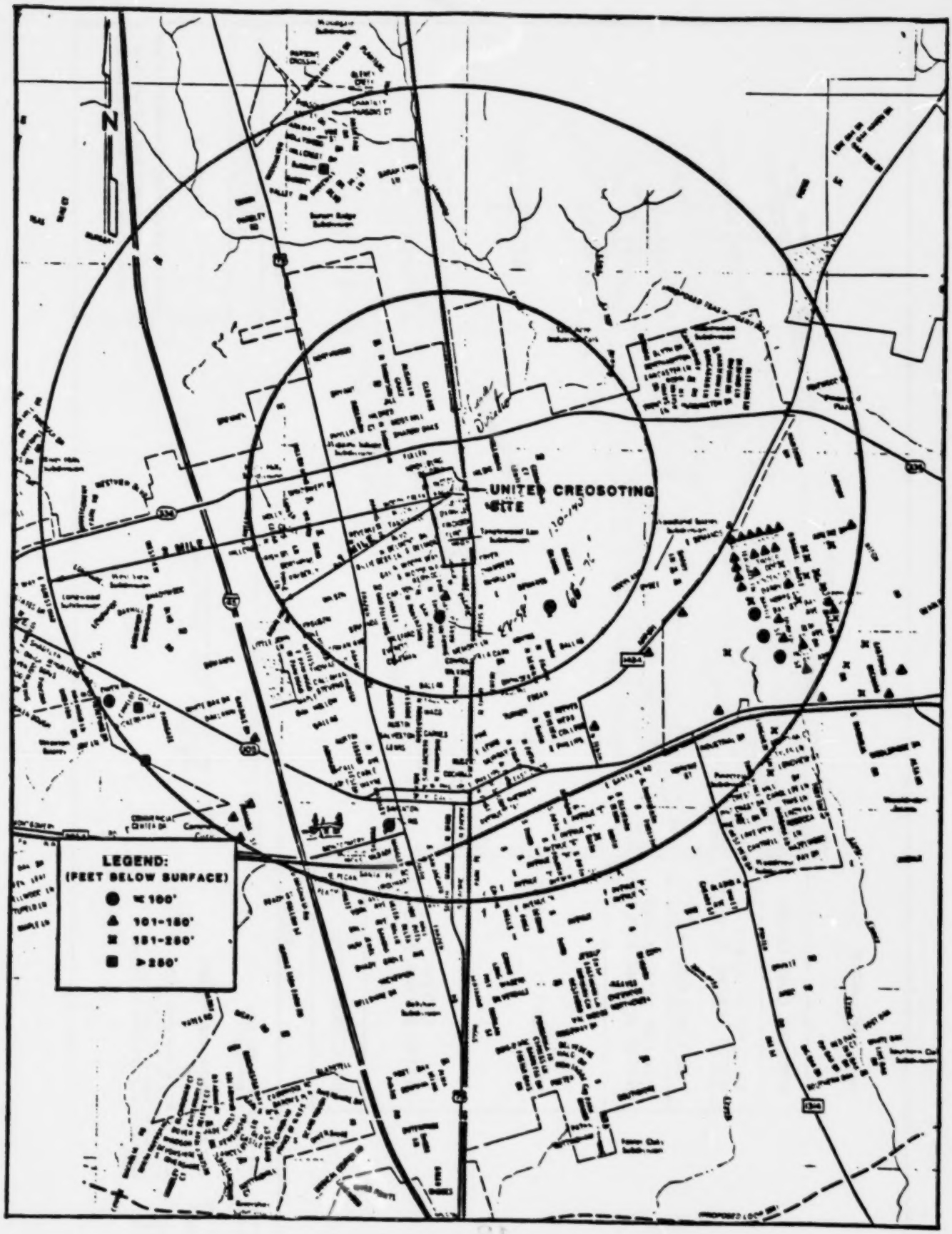
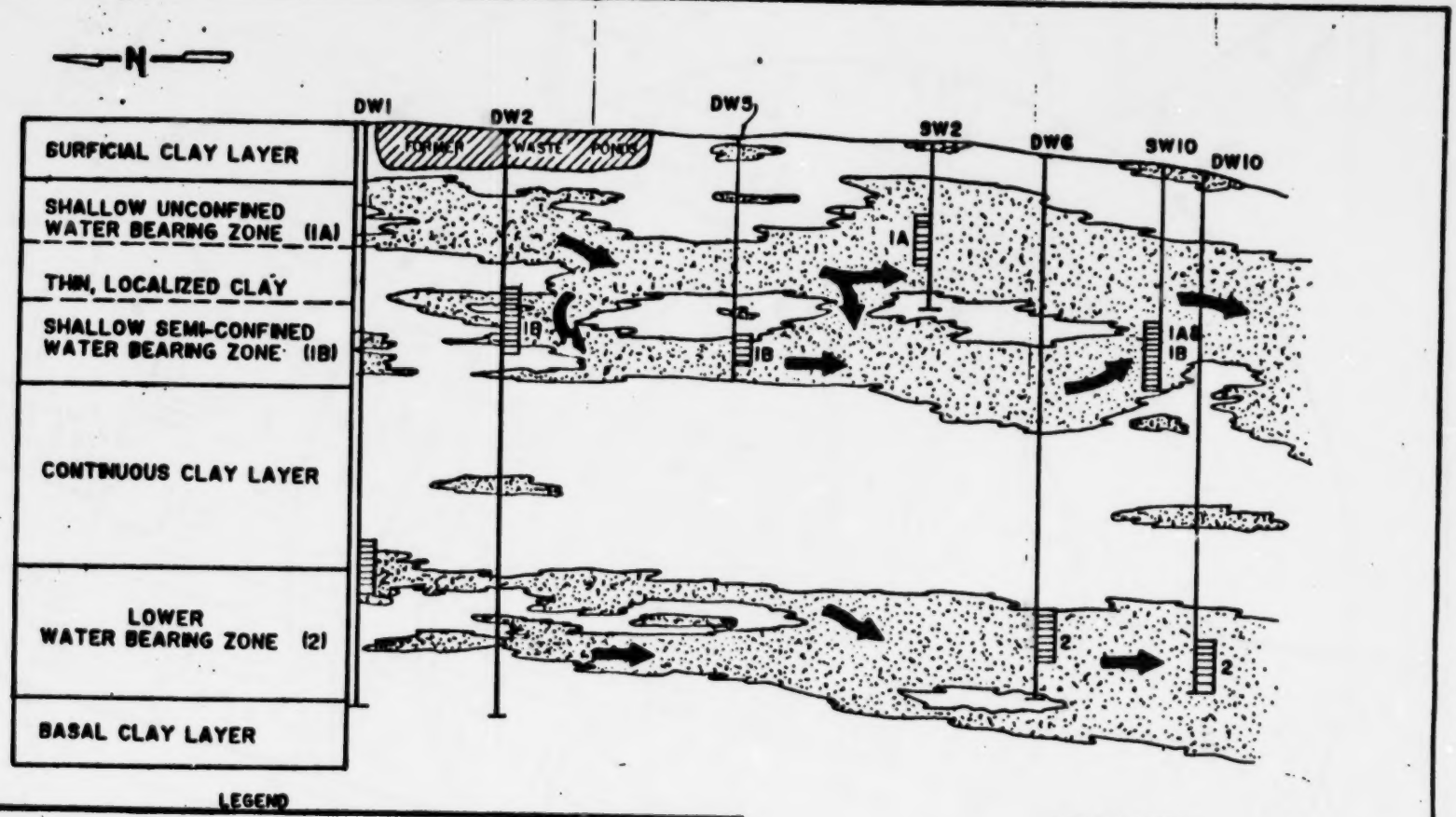

UNITED CREOSOTING
SITE
LEGEND:
(FEET BELOW SURFACE)
≤ 100'
101-150'
151-250'
> 250'

FIGURE 6



LEGEND

FINE TO MEDIUM GRAINED SAND SOMETIMES W/TRACE CLAY

CLAY WITH SAND AND SAND STRINGERS

SCHEMATIC BORING WITH APPROXIMATE SCREENED INTERVAL (1A-SHALLOW UNCONFINED ZONE; 1B-SHALLOW SEMI-CONFINED ZONE, 2-LOWER WATER BEARING ZONE)

NORTH-SOUTH LOCATION OF FORMER WASTE PONDS

DIRECTION OF DOMINANT GROUND-WATER FLOW THROUGH WATER BEARING SAND ZONES

NOT TO SCALE

WESTON

FIGURE 7

UNITED CREOSOTING FEASIBILITY STUDY
SCHEMATIC CROSS SECTION OF NEAR SUBSURFACE HYDROGEOLOGIC UNITS

The shallow water bearing zone is characterized by an extremely low yield and use of this zone as a domestic water resource is not anticipated.

Below the shallow water bearing zone is a clay layer, averaging 30 feet thick. The permeability of this layer is approximately 10^{-5} feet/day, indicative of clays which can retard vertical migration.

The second water bearing zone exists at an approximate depth of 56 to 84 feet below the ground surface. The zone is approximately 20 feet thick and groundwater movement is estimated to be 5 to 15 feet/year toward the south.

The potential for vertical migration of contaminants from the 25-foot to the lower water bearing zone was evaluated in the RI. Based on the permeability of the aquitard and the hydraulic gradient between the two zones, two conclusions can be drawn:

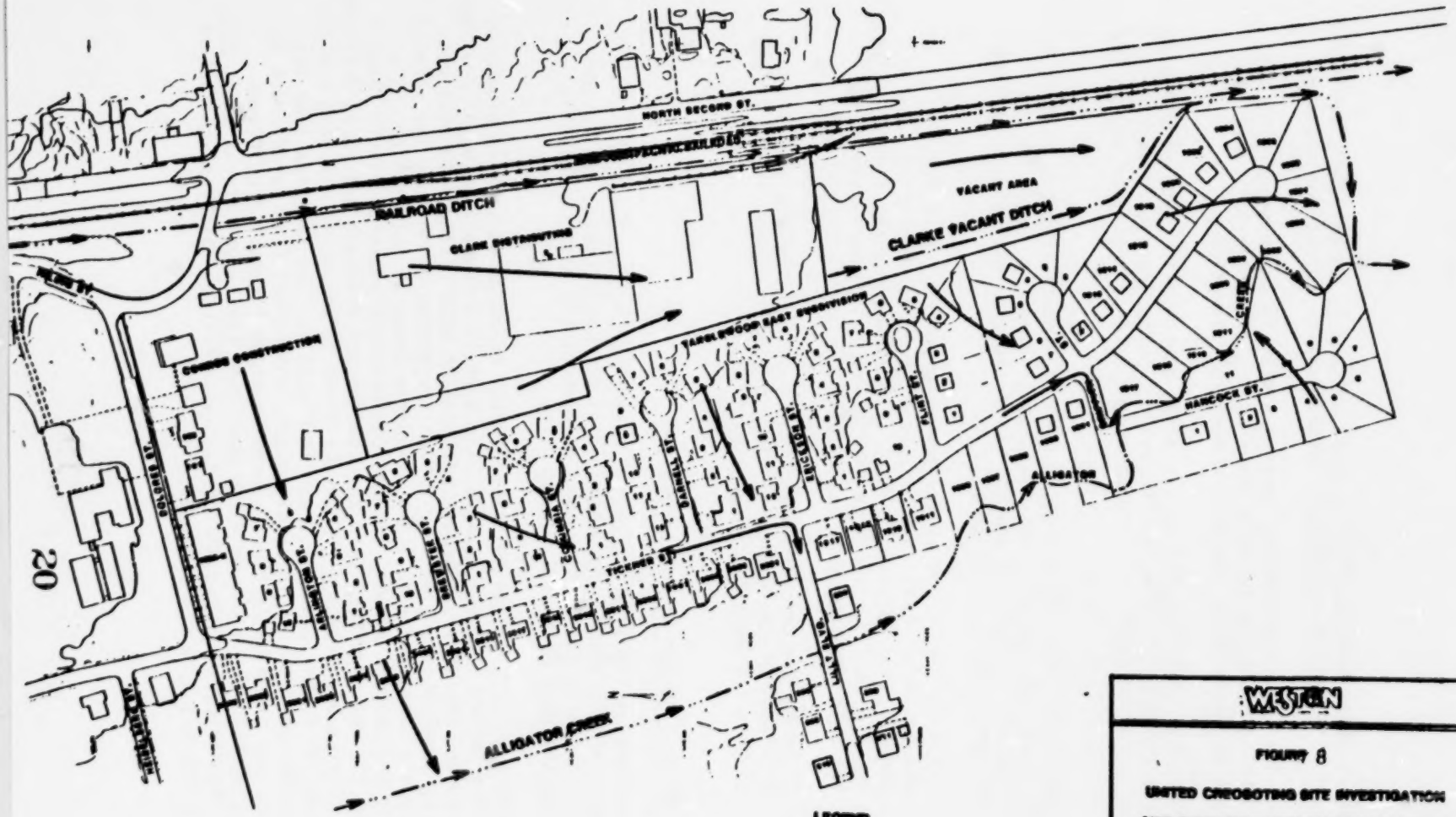
- There is low potential for downward vertical flow from the shallow water bearing zone to the lower water bearing zone. However, due to sands lenses, thin interconnected sand stringers, and slickensided surfaces in the aquitard, some areas below the site may show more accelerated vertical migration rates.

- Based on the calculated vertical flow velocity and the thickness of the confining clay, groundwater penetration of the clay is not expected for at least 100 years.

Surface Water Flow and Site Drainage

The United Creosoting site is located east of Alligator Creek and is situated wholly within the watershed of Alligator Creek. Alligator Creek, which skirts the southwestern portion of the site, eventually flows into the West Fork San Jacinto River.

Site surface water drainage enters Alligator Creek at various locations on and off the United Creosoting site. The overall site surface water drainage flow is toward the south, although patterns on much of the site have been altered by development. The subdivision properties drain into the streets of Tanglewood East, and then, into Alligator Creek at culverts on Lilly Boulevard and Hancock Street. Conroe Construction property runoff flows mainly to the west and then into the subdivision drainage system at Arlington Street. Clarke Distributing properties drain to the south and into a ditch which feeds Alligator Creek as shown in Figure 8. The cap area over the former waste ponds drains into this ditch, and runoff from paved areas is forcd into the ditch by curbing. There is minimal runoff from Clarke Distributing into the drainage ditch that runs the length of the site, just west of the Missouri-Pacific Railroad. This railroad ditch and the vacant area drainage ditch do not interact.



WESTON

FIGURE 8

UNITED CREOSOTING SITE INVESTIGATION

SITE SURFACE WATER DRAINAGE PATTERN

EXTENT AND MAGNITUDE OF CONTAMINATION

Data from the remedial investigation indicates the presence of contamination from creosoting compounds and PCP in surficial and subsurface soils and shallow groundwaters at the United Creosoting site. The remedial investigation activities, combined with a review of the site history, resulted in the definition of the following areas of contamination at the site:

- Subsurface (3 to 25 foot deep) soil contamination in the area of the former waste ponds and an area formerly occupied by a tank farm.
- Surficial (ground level to 3 feet deep) soil contamination in areas of the site visually marked by an accumulation of asphaltic wastes ("tar mats"), thin crust material, darkened soils, or stressed vegetation and in areas of surficial water runoff including a large previously "swampy" area south and west of the former waste ponds.
- Shallow groundwater contamination in two interconnected water bearing strata found from about 15 to about 50 feet below ground surface.

Significant contamination of air, stormwater runoff, surface waters or sediments of Alligator Creek, lower groundwaters, households, or structures was not detected during the remedial investigation.

The areal extent of soil and shallow groundwater contamination is summarized in Figure 9. These estimates are keyed to volumes which contain contaminants in excess of levels possibly impacting human health (as recommended by the Centers for Disease Control).

Volumes of soil and groundwater contaminated above the CDC guidelines are estimated to be:

- 13,000 cubic yards of waste pond materials;
- 27,000 cubic yards of contaminated soils below and adjacent to the former waste ponds;
- 20,000 cubic yards of contaminated residential surficial soils;
- 9,500 cubic yards of contaminated industrial surficial soils.
- 13,000,000 gallons of contaminated shallow unconfined groundwaters; and
- 30,000,000 gallons of contaminated shallow semi-confined groundwaters.

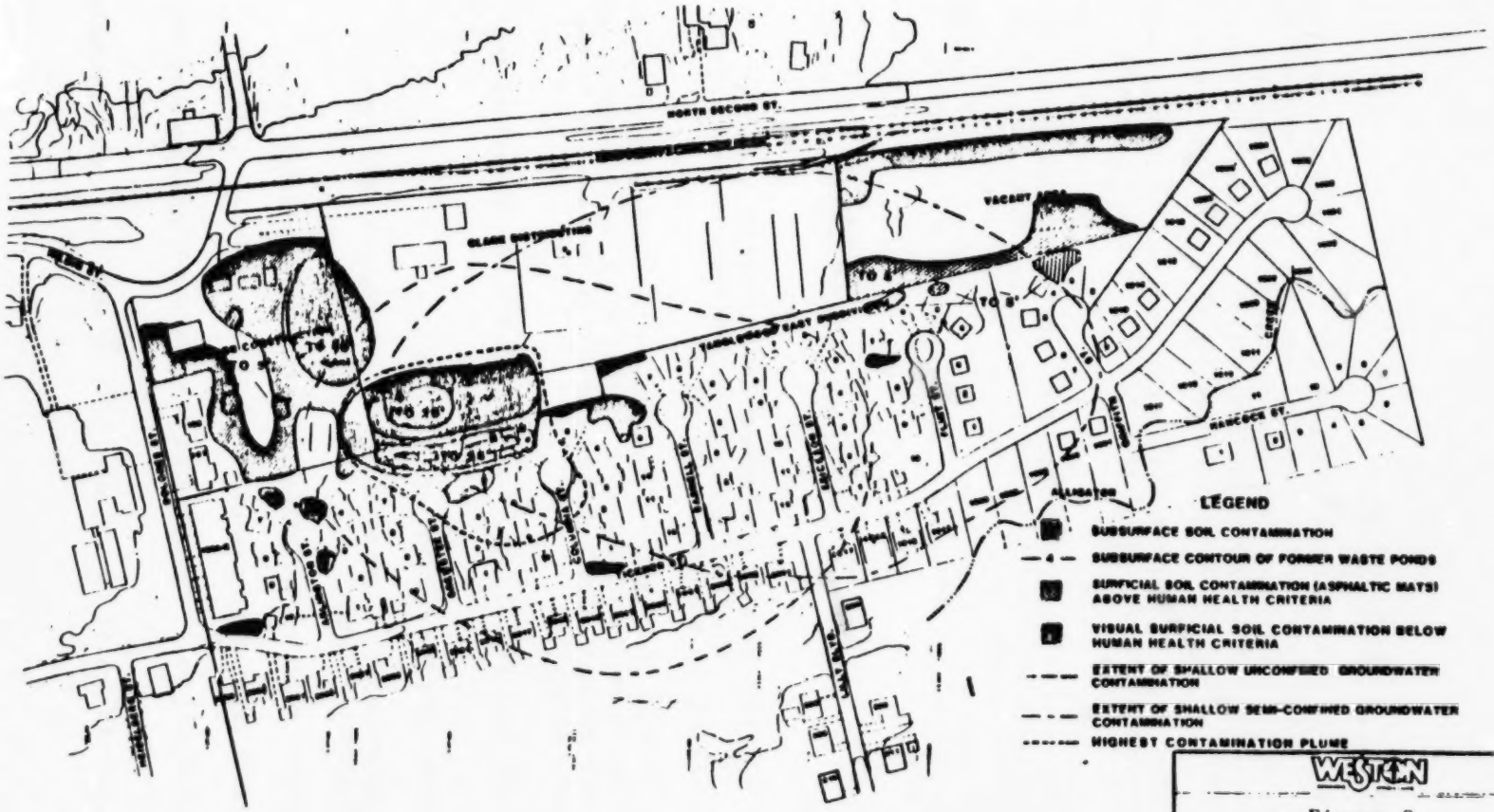


Figure 9

Contaminated Media Above Human Health Criteria

A smaller volume of contaminated shallow groundwater was identified during development of the feasibility study. This volume, 7,000,000 gallons, is comprised of groundwater contaminated with greater than 21 ug/l of pentachlorophenol. This concentration of PCP was identified as an EPA Health Advisory at the beginning of the feasibility study. During the course of the study, EPA developed a less stringent advisory level of 1.05 mg/l. The latter concentration was considered in the evaluation of the groundwater alternatives.

Chlorinated Dioxins and Dibenzofurans

Chlorinated dibenzodioxins and polychlorinated dibenzofurans are known to occur as impurities during the manufacture of pentachlorophenol (PCP). Since the United Creosoting Company was known to use PCP in its wood-preserving operations, selected soil samples from the site were analyzed for the these compounds. Samples were specifically analyzed for the highly toxic and strictly regulated 2,3,7,8 - tetradioxin isomer. It was not detected at the site, and is not expected to be found in wood preserving wastes. However, other chlorinated dioxin and furan isomers, were detected in areas of surficial and subsurface soils where polynuclear aromatic hydrocarbons (PAHs) and PCP were also found.

The threat to human health posed by chlorinated dioxins is based on a standard of 1.0 part per billion (ppb) of 2,3,7,8 - tetradioxin in residential surface soils. All other isomers of dioxins and dibenzofurans are considered less toxic by toxic equivalency. A comparison of the toxic equivalencies and concentrations of the isomers of dioxin and dibenzofurans detected during the RI indicates that no threat to human health or the environment is posed by the presence of these compounds at United Creosoting.

The presence of the chlorinated dioxin isomers limits the off-site alternatives for remedial action. Currently, the Environmental Protection Ageny recommends (Guidance for Implementating the RCRA Dioxin Listing Rule, August 1985) that materials containing tetra-, penta-, or hexachlorinated dioxins or furans be treated as acute hazardous wastes. The guidance further specifies that PCP wood treatment wastes are to be considered under the dioxin listing rule requirements. Inclusion under the dioxin listing rule places strict limitations on off-site commercial waste disposal. Currently, there are no commercial facilities in the United States that are permitted to accept dioxin-contaminated wastes for disposal.

Summary of Site Impacts

Polynuclear aromatic hydrocarbons, pentachlorophenol, and chlorinated isomers of dioxins and dibenzofurans were detected in the surface soils, subsurface soils and shallow groundwater at United Creosoting. These contaminants can impact human health through ingestion or direct contact with skin. The levels at which human health may begin to be impacted by the contaminants at United Creosoting have been recommended by the Centers for Disease Control.

The data collected at the United Creosoting site supports the following concerns:

- Temporary releases of volatile organic compounds are probable during any disturbances within areas of extensive subsurface contamination;
- Shallow groundwaters in the site vicinity have been contaminated with semi-volatile organic compounds. About 43,000,000 gallons of groundwater, present in two interconnected shallow zones, are contaminated in excess of background concentrations;
- Lower groundwater quality is currently unaffected by the contaminants from the United Creosoting Company;
- Surficial soil contamination is evident across the site. Localized areas are contaminated to an extent which may impact human health by direct contact with soils;
- Extensive subsurface soil contamination is present in the area of the former waste ponds and below the former tank farm and coal tar distillation unit. These soils continue to impact groundwater quality. Concentrations of pentachlorophenol and polynuclear aromatics were the highest found on-site and far exceed recommended criteria for the protection of human health;
- Detectable contamination is not present in Tanglewood East homes; and
- Vegetation on-site has been visibly stressed. This stress may be due to contamination at the site and/or the disturbances caused by site development.

CONTAMINANT MIGRATION PATHWAYS

Air

Monitoring during the remedial investigation indicated that PAHs are not currently affecting air quality and do not pose an immediate threat to the public. However, any significant disturbance of the site or lack of maintenance of a protective cover could cause future air quality degradation in the vicinity of the site.

Surface Water and Site Runoff

Contamination was not detected in any of the storm water runoff samples. These results seem to indicate that the Immediate Action undertaken in January 1984 to cap exposed soils on Clarke Distributing property was

successful in halting the migration of contaminants from the former waste pond area in this manner. While storm water runoff is not currently contributing to significant contaminant migration, future problems may arise due to a lack of maintenance of caps over the former pond and tank farm areas.

Groundwater

The primary route of contaminant migration at United Creosoting is via the 25-foot water bearing zone. The groundwater in this zone is moving horizontally at a rate of 10 to 15 feet per year. Because PAHs and PCP exhibit low mobility and a tendency to adsorb onto soil, the contaminant plume can be expected to migrate at a slower rate. As stated previously, the aquitard below this water bearing zone is expected to be an adequate barrier to vertical migration of the contaminants.

As a result of removing or isolating the source of contamination to the groundwater (the pond area) by a remedial action, natural attenuation of the plume would be expected. Dilution, adsorption, and possible biodegradation of the contaminants would result in a decrease in concentration over time. This is discussed further in the "Groundwater Alternatives" section of this Record.

Target Receptors

The following target receptors were identified in the remedial investigation:

- Persons disturbing the subsurface soil by excavation for property improvement; and

- children playing in the area of the "asphaltic mats" in the residential area.

Enforcement

During the course of an ongoing investigation, EPA has identified two Potentially Responsible Parties (PRPs) for this site. Notice letters were sent to all known PRPs in August 1986. PRPs have been given the opportunity to participate in all actions that have been taken to date. Betweem December 1983 and March 1984, Clarke Distributing Company, in compliance with AO on Consent issued by EPA, capped the former pond area and improved the drainage away from the Tanglewood East residential area.

Although no response have been received from the August 1986 notice letters, the PRPs will be offered the opportunity to participate in the implementation of the selected remedy. If negotiations are unsuccessful, it is recommended that the cleanup be Fund financed, and appropriate enforcement action be sought at a later date. Any additional PRPs identified will also be offered the opportunity to voluntarily implement the recommended remedy.

Current homeowners received notice letters indicating their status as PRPs, since present policy dictates that current landowners be designated as PRPs in order to acquire a release or access to the property in question. In the event that access is denied, the Agency retains the option to initiate cost recovery actions. However, access to the property has not been a problem at this site, thereby precluding cost recovery actions sought against the homeowners in the Tanglewood East Subdivision.

ALTERNATIVES EVALUATION

The Feasibility Study (FS) for United Creosoting was performed to determined what actions, if any, would be appropriate as a permanent remedy. Several alternative remedial methods were developed by Roy F. Weston, Inc. The ultimate objective of the FS was to develop alternatives to adequately protect public health and the environment from past and potential releases of contaminants currently onsite.

The major threats to public health and the environment attributed to the site are:

- Direct contamination of shallow groundwater by leaching from the former pond and tank farm areas and possible future contamination of the lower groundwater zones;

- future direct contact with subsurface soils from the pond and tank farm areas due to excavation activities; and

- potential airborne transport of soils and volatile organic compounds from the pond and storage areas.

Remedial Objectives

The overall objective of any remedy selected at any Superfund site is the protection of human health and the environment. Objectives for specific media at United Creosoting are listed in Table 2.

In accordance with the National Contingency Plan (NCP), the requirements of Federal environmental regulations, guidances, and advisories are appropriate in determining the extent of remedial action at a site. In the absence of such standards, a risk assessment model should be used to determine the extent of remedial action. No regulatory standards for cleanup levels were identified for the contaminants at United Creosoting.

The remedial criteria developed for United Creosoting are presented in Table 3. These criteria were developed from health assessments guidance provided by the Centers for Disease Control. Also taken into account were the current land use (residential and commercial) and current and potential use of the shallow water bearing zone (none). Documentation of the Centers' guidance is attached to this Record of Decision.

TABLE 2

SELECTED PLANNING OBJECTIVES
UNITED CREOSOTING COMPANY SITE

CONTAMINANT PATHWAY	OBJECTIVE	CRITERIA
Groundwater - Shallow Water Bearing Zones	No further degradation of shallow groundwater quality on- and off-site.	Shallow groundwater contaminant concentrations not to exceed current measured conditions
Groundwater- Lower Water Bearing Zones	Prevent lower groundwater degradation.	Maintain lower groundwater at background levels
Soils - Surficial	Reduce contaminants to prevent any acute or chronic effects on human health and environment.	Reduce/isolate high contaminant concentrations to levels protecting human health and the environment
Soils - Subsurface	Reduce contaminants to prevent any acute or chronic impacts on human health and environment.	Reduce/isolate high contaminant concentrations to levels protecting human health and the environment
Surface Waters	Prevent surface water degradation.	Maintain background surface water quality levels.
Air	Prevent degradation of air quality on- or off-site.	Maintain background air quality levels.

TABLE 3

CRITERIA FOR SITE CONTAMINANTS IN SOILS
TO AVOID CHRONIC HUMAN HEALTH IMPACTS
RECOMMENDED BY CENTER FOR DISEASE CONTROL
UNITED CREOSOTING COMPANY SITE

COMPOUND	CONCENTRATION
Total Polynuclear Aromatics	100 mg/kg
Pentachlorophenol	150 mg/kg
Tetra-Dioxin	1 ug/kg
Penta-Dioxin	5 ug/kg
Hexa-Dioxin	25 ug/kg
Hepta-Dioxin	1000 ug/kg
Octa-Dioxin	N.A.

The objectives and criteria are specific to United Creosoting and provide the basis for identifying and evaluating possible remedial alternatives for the site. A more complete discussion of the development of the remedial objectives and criteria can be found in Section 3 of the Feasibility Study.

Identification and Screening of Technologies

The process by which potential remedial alternatives are developed and evaluated is outlined in Section 300.68 of the NCP. The first step in this process is the identification and screening of technologies that may be applicable to the site conditions. Screening was done by applying the following criteria:

- environmental effectiveness;
- cost; and
- technical feasibility and implementability.

Technologies which were judged incapable of satisfying the above criteria were eliminated. A summary of the initial evaluation stage is presented in Tables 4 and 5.

Detailed Evaluation of Alternatives

Alternatives retained from the initial screening, and the "No Action" alternative were evaluated to assess their relative effectiveness in protecting public health and the environment. The detailed evaluation included:

- detailed specifications;
- analyses of adverse environmental impacts;
- assessment of public health and environmental protection;
- detailed cost estimates, including operation and maintenance and net present values; and
- schedules.

Summaries of the results of the detailed evaluation of retained alternatives are presented in Tables 6, 7, and 8. These alternatives were then narrowed down to three groundwater remedial alternatives, five source control (soils) alternatives, and the "No Action" alternative. Brief discussions of these final alternatives are presented in the following sections of this Record.

Groundwater Alternatives

Fifteen different groundwater methods were developed and evaluated in the feasibility study. Screening criteria for these methods included time to complete the remedy and cost of the treatment technology used. A detailed discussion of the evaluation of these methods is presented in Section 5.3.2

TABLE 4

POTENTIAL REMEDIAL ACTION METHODS
UNITED CREOSOTING COMPANY SITE

SHALLOW GROUNDWATERS

- Natural attenuation
- Natural attenuation after source removal/isolation
- Withdrawal with off-site disposal by:
  - deep well injection
  - biological or physical/chemical treatment
  - incineration
  - solidification and landfill
- Withdrawal with on-site treatment and discharge. Treatment accomplished by:
  - biological oxidation
  - chemical oxidation/detoxification
  - activated carbon adsorption
  - UV photolysis
  - incineration
  - air stripping
- Withdrawal with on-site treatment and reinjection. Treatment accomplished as noted above.
- Withdrawal and on-site storage
- Plume containment by:
  - barriers such as slurry walls
  - gradient control wells
- In-situ treatment by:
  - enhanced microbial degradation
  - chemical injection

SURFICIAL AND SUBSURFACE SOILS

- Excavation with off-site treatment/disposal by:
  - incineration
  - landfill
- Excavation with interim storage by either:
  - on-site facilities, or
  - off-site facilities

TABLE 4 (cont.)

POTENTIAL REMEDIAL ACTION METHODS
UNITED CREOSOTING COMPANY SITE

SURFICIAL AND SUBSURFACE SOILS (Cont.)

- Excavation with on-site disposal by:
  - RCRA compliant landfill
  - waste encapsulation
- Excavation with on-site treatment by:
  - incineration
  - biological treatment
  - solvent extraction
  - UV photolysis
  - chemical oxidation/detoxification
- On-site treatment followed by on-site reburial of residues or off-site disposal as non-hazardous waste
- Infiltration controls by:
  - clay
  - synthetic membrane
  - soil admixtures
- In-situ treatment by:
  - enhanced biological degradation
  - soil aeration
  - waste fixation/stabilization
  - solvent extraction followed by groundwater recovery
- No action

SITE MANAGEMENT

- Grading
- Revegetation
- Surface water diversion
- Monitoring and maintenance
- Fencing
- Land use controls

TABLE 5

ALTERNATIVE REMEDIAL ACTION METHODS
UNITED CREOSOTING COMPANY SITE
INITIAL SCREENING RESULTS - REJECTED METHODS

REJECTED METHODS	REASON FOR REJECTION
SHALLOW GROUNDWATERS	
o Withdrawal with on-site treatment by:	
- UV photolysis	Treatment technology required is costly to operate and displays variable treatment efficiencies necessitating an effluent polishing step such as activated carbon adsorption.
- air stripping	Contaminants present display low volatilities, making treatment technically difficult. Environmental risk with air releases in populated area.
o Withdrawal and on-site storage	Inconsistent with planning objectives. Excessive costs due to time span required to implement withdrawal and size of storage units.
o Plume containment by:	
- gradient control wells	Technically ineffective due to slow-moving hydrogeology of shallow water bearing zones.
o In-situ treatment by:	
- chemical injection	Contaminants present are resistant to chemicals other than strong oxidizers. Treatment technology required costly and difficult to implement in slow-moving system.

TABLE 5 (cont.)

ALTERNATIVE REMEDIAL ACTION METHODS
UNITED CREOSOTING COMPANY SITE
INITIAL SCREENING RESULTS - REJECTED METHODS

REJECTED METHODS	REASON FOR REJECTION
SURFICIAL AND SUBSURFACE SOILS	
o In-situ treatment by:	
- enhanced biological degradation	Not implementable. Applicable to surface soils only. Contaminant concentrations in waste ponds likely toxic to bacteria. Silty clays hinder diffusion of bacteria and nutrients through site soils. By-products of biological destruction may also be hazardous.
- soil aeration	Contaminants present display low volatilities making treatment technically not feasible.
- waste fixation/ stabilization	Inconsistent with planning objectives. Difficult to implement due to depth of contamination.
- solvent extraction followed by groundwater recovery.	Required solvents also hazardous and likely to adsorb onto soils. Excessive costs due to long time periods required for groundwater recovery.

TABLE 5 (cont.)

ALTERNATIVE REMEDIAL ACTION METHODS
UNITED CREOSOTING COMPANY SITE
INITIAL SCREENING RESULTS - REJECTED METHODS

REJECTED METHODS	REASON FOR REJECTION
SURFICIAL AND SUBSURFACE SOILS	
o Excavation with interim storage by:	
- on-site facilities	Inconsistent with planning objectives. Excessive costs in comparison to in-situ storage.
- off-site facilities	No identified commercial storage facility due to presence of chlorinated dioxin. Excessive costs.
o Excavation with on-site treatment by:	
- solvent extraction	Required solvents also hazardous and must be treated. Not a method in itself.
- UV photolysis	Treatment technology is inconsistent with waste pond materials. Difficult to maintain feed stream.
o Infiltration controls by:	
- soils admixtures	Inconsistent with planning objectives. Difficult to implement due to depth of contamination.
- synthetic membrane	Not environmentally effective in populated area. Would also require soil covering.

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

UNITED CREOSOTING COMPANY

CONROE, TEXAS

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

UNITED CREOSOTING COMPANY

CONROE, TEXAS

TABLE OF CONTENTS

Background	1
Site History	1
Current Site Status	3
Extent and Magnitude of Contamination	8
Contaminant Migration Pathways	10
Enforcement	11
Alternatives Evaluation	12
Community Relations	17
Consistency with Environmental Laws	17
Recommended Alternative	18
Operation and Maintenance	20
Schedule	20

TABLE 6

TIME REQUIREMENTS FOR SHALLOW GROUNDWATER REMEDIATION
UNITED CREOSOTING COMPANY SITE

WITHDRAWAL AREA/ SLURRY WALL AREA	TREATMENT/DISPOSAL METHOD	INJECTION COMPONENT	APPROXIMATE NUMBER OF YEARS TO REACH BACKGROUND QUALITY	
Entire Plume	Off-Site Disposal	None	150	
Entire Plume	Off-Site Disposal	Inject to Enhance Removal	20	
Entire Plume	On-Site Treatment	None	150	
Entire Plume	On-Site Treatment	Inject to Enhance Removal; Discharge Treated Waters	20	
Entire Plume	On-Site Treatment	Reinject Treated Groundwater	20	
			Pump Area	Remaining Plume
Highest Contamination	Off-Site Disposal	None	40	300
Highest Contamination	Off-Site Disposal	Inject to Enhance Removal	5	300
Highest Contamination	On-Site Treatment	None	40	300
Highest Contamination	On-Site Treatment	Inject to Enhance Removal; Dishcarge Treated Waters	5	300
Highest Contamination	On-Site Treatment	Reinject Treated Groundwater	5	300
			Pump Stagnation Point	No Well
Slurry Wall Around Pond Area	Slurry Wall	None	340	>>400
Slurry Wall Around Highest Concentration Plume	Slurry Wall	None	310	>>400
No Action	None	None	400	

TABLE 7

SUMMARY OF REMEDIAL ACTION METHOD COST ESTIMATES
UNITED CREOSOTING COMPANY SITE

REMEDIAL METHOD	TOTAL CAPITAL COST	MONITORING AND MAINTENANCE ANNUAL	MONITORING AND MAINTENANCE PRESENT WORTH	TOTAL PRESENT
SHALLOW GROUNDWATERS				
Natural Attenuation	$51,000	$ 6,000	$ 71,000	$ 120,000
Entire Plume Withdrawal With[1] Off-Site Disposal by:				
-Deep Well Injection	69,000,000	300,000	32,000,000	72,000,000
-Incineration	100,000,000	300,000	3,200,000	100,000,000
-Biological/Chemical Treatment	85,000,000	300,000	3,200,000	88,000,000
-Solidification and Landfill	180,000,000	300,000	3,200,000	180,000,000
Entire Plume Withdrawal With[1] On-Site Treatment and Discharge. Treatment Accomplished by:				
-Activated Carbon Adsorption	5,100,000	380,000	3,200,000	8,300,000
Entire Plume Withdrawal With[1] With Treatment and Reinjection. Treatment Accomplished by:				
-Activated Carbon Adsorption	4,500,000	380,000	3,200,000	7,700,000
Highest Contamination Plume[2] Withdrawal with Off-Site Disposal by:				
-Deep Well Injection	6,900,000	190,000	900,000	7,800,000
-Incineration	10,000,000	190,000	900,000	11,000,000
-Biological/Chemical Treatment	8,500,000	190,000	900,000	9,400,000
-Solidification and Landfill	18,000,000	190,000	900,000	19,000,000

1 Entire plume withdrawal methods include an injection component to reduce remedation time to 20 years.
2 Highest contamination plume withdrawal methods include an injection component to reduce remediation time to 5 years.

TABLE 7 (cont.)

SUMMARY OF REMEDIAL ACTION METHOD COST ESTIMATES
UNITED CREOSOTING COMPANY SITE

REMEDIAL METHOD	TOTAL CAPITAL COST	MONITORING AND MAINTENANCE ANNUAL	MONITORING AND MAINTENANCE PRESENT WORTH	TOTAL PRESENT WORTH
Highest Contamination Plume[2] Withdrawal with On-Site Treatment and Discharge. Treatment Accomplished by:				
-Activated Carbon Adsorption	1,600,000	300,000	1,200,000	2,800,000
Highest Contamination Plume Withdrawal with On-Site Treatment and Reinjection. Treatment Accomplished by:				
-Activated Carbon Adsorption	$1,500,000	240,000	1,200,000	2,700,000
-Biological Activated Sludge	5,800,000	800,000	3,100,000	8,900,000
Plume Containment by:				
-Bentonite Clay Slurry Walls Around Former Waste Ponds	790,000	2,500	190,000	980,000
-Bentonite Clay Slurry Walls Around Highest Contamination Plume Area	1,200,000	21,000	300,000	1,500,000
SURFICIAL AND SUBSURFACE SOILS				
Excavation with Off-Site Treatment/ Disposal by:				
-Incineration[3]	140,000,000	--	--	140,000,000
-Landfill[3]	24,000,000	--	--	24,000,000
Excavation with On-Site Disposal by:				
-RCRA Compliant Landfill	8,900,000	65,000	800,000	9,700,000

2 Highest contamination plume withdrawal methods include an injection component to reduce remediation time to 5 years.
3 No compliant facilities currently available for wastes containing chlorinated dibenzofurans.

TABLE 7 (cont.)

SUMMARY OF REMEDIAL ACTION METHOD COST ESTIMATES
UNITED CREOSOTING COMPANY SITE

MEDIAL METHOD	TOTAL CAPITAL COST	MONITORING AND MAINTENANCE ANNUAL	MONITORING AND MAINTENANCE PRESENT WORTH	TOTAL PRESENT WORTH
cavation with On-Site Treatment and Reburial. Treatment Accomplished by:				
-Incineration	17,000,000	--	8,000,000	25,000,000
-Land Farming	12,000,000	--	--	12,000,000
-Biological Slurry	13,000,000	--	200,000	13,000,000
-Chemical Oxidation	84,000,000	--	25,000,000	110,000,000
ste Encapsulation by:				
-Clay Cap and Slurry Walls in Former Waste Ponds and Tank Farm Areas	2,900,000	54,000	650,000	3,600,000
-Clay Cap and Slurry Walls after Transfer of Tank Farm Soils to Waste Ponds	3,400,000	54,000	600,000	4,000,000
filtration Controls by:				
-Clay Cap in Former Waste Ponds and Tank Farm Areas	2,100,000	43,000	490,000	2,600,000
-Clay Cap after Transfer of Tank Farm Soils to Waste Ponds	2,600,000	43,000	510,000	3,100,000
terim Capping Followed by Excavation and Off-Site Disposal in Landfill	25,000,000	43,000	230,000	25,000,000
Action	51,000	49,000	70,000	120,000

lo compliant facilities currently available for wastes containing chlorinated dibenzodioxins.

TABLE 8

ALTERNATIVE REMEDIAL ACTION METHODS DETAILED SCREENING RESULTS
UNITED CREOSOTING COMPANY SITE

REMEDIAL METHOD	STATUS	COMMENTS
SHALLOW GROUNDWATERS		
Natural Attenuation	Not Preferred	Requires an estimated 400 years to achieve planning objectives. No action alternative.
Natural Attenuation After Source Removal or Isolation	Preferred	Method achieves planning objectives, but requires long period of implementation.
Entire Plume Withdrawal with Off-Site Disposal	Not Preferred	Excessive costs due to 150-year implementation period. Withdrawal network negatively impacts residential area.
Entire Plume Withdrawal with On-Site Treatment and Discharge	Not Preferred	Excessive costs due to 150-year implementation period. Withdrawal network negatively impacts residential area.
Entire Plume Withdrawal/Injection with Off-Site Disposal	Not Preferred	Excessive costs due to 20-year implementation period. Withdrawal/injection network negatively impacts residential area.
Entire Plume Withdrawal/Injection with On-Site Treatment and Discharge	Not Preferred	Excessive costs due to 20-year implementation period. Withdrawal/injection network negatively impacts residential area.
Entire Plume Withdrawal with On-Site Treatment and Reinjection	Not Preferred	Excessive costs due to 20-year implementation period. Withdrawal/injection network negatively impacts residential area.
Highest Contamination Plume Withdrawal with Off-Site Disposal	Not Preferred	Excessive costs due to 40-year implementation period. Withdrawal network negatively impacts residential area.
Highest Contamination Plume Withdrawal with On-Site Treatment and Discharge	Not Preferred	Excessive costs due to 40-year implementation period. Withdrawal network negatively impacts residential area.

TABLE 8 (cont.)

ALTERNATIVE REMEDIAL ACTION METHODS DETAILED SCREENING RESULTS
UNITED CREOSOTING COMPANY SITE

REMEDIAL METHOD	STATUS	COMMENTS
SHALLOW GROUNDWATERS		
Highest Contamination Plume Withdrawal/ Injection with off-site disposal	Not Preferred	Excessive costs in comparison to on-site treatment options. Negative impact to residential area during 5 years remediation.
Highest Contamination Plume Withdrawal/ Injection with on-site treatment and discharge	Not Preferred	Excessive costs in comparison to reinject method. Negative impact to residential area during 5 years remediation.
Highest Contamination Plume Withdrawal with on-site treatment and reinjection	Preferred	Removes some contaminants from site. Activated carbon absorption cost-effective treatment method. Negative impact to residential area during 5 year remediation.
Containment of Waste Pond Plume by Bentonite Clay Slurry Wall	Preferred	Technically acceptable and implementable. Achieves planning objectives. Negative long-term impact to residential area because contaminants remain on site.
Containment of Highest Contamination area plume by Bentonite Clay Slurry Wall	Not Preferred	Achieve same objective as waste pond slurry wall at highest cost. Negative long-term impact to residential area because contaminants remain on site.
In-site treatment by enhanced Biological Degradation	Not Preferred	Not implementable. Degree of treatment possible not defined. Potential for high costs due to requirements for closely spaced injection network.
SURFICIAL AND SUBSURFACE SOILS		
Excavation with Off-Site Treatment by: - Incineration	Not Preferred	Excessive costs. Not implementable since no compliant facilities currently available.
- Landfill	Not Preferred	Not implementable since no complaint facilities currently available.

TABLE 8 (cont.)

ALTERNATIVE REMEDIAL ACTION METHODS DETAILED SCREENING RESULTS
UNITED CREOSOTING COMPANY SITE

REMEDIAL METHOD	STATUS	COMMENTS
Excavation with On-Site Disposal by:		
- RCRA Compliant Landfill	Preferred	Technically acceptable and implementable on-site waste management alternative. Requires long term maintenance and monitoring. Alters appearance of neighborhood and use of land.
- Waste Encapsulation	Not Preferred	Technically acceptable and implementable on-site waste alternative. However, accomplishes same soil remediation as infiltration controls at greater cost.
Excavation with On-Site Treatment* by:		
- Incineration	Preferred	Technically acceptable and implementable, cost effective, destructive technology.
- Biological Slurry	Not Preferred	Technically unproven. May have excessive costs. Requires large tract of land.
- Land Farming	Not Preferred	Long implementation period due to on-site land availability.
- Chemical Oxidation	Not Preferred	Excessive costs.

* Includes on-site reburial of treated wastes.

TABLE 8 (cont.)
ALTERNATIVE REMEDIAL ACTION METHODS DETAILED SCREENING RESULTS
UNITED CREOSOTING COMPANY SITE

REMEDIAL METHOD	STATUS	COMMENTS
SURFICIAL AND SUBSURFACE SOILS		
Infiltration Controls by:		
- Clay Cap	Preferred (2 Caps)	Least costly technology. Requires longterm maintenance and monitoring. Permanently alters neighborhood and use of land.
- Interim Capping Followed by Excavation and Off-Site Disposal by Landfill	Preferred	Technically acceptable and implementable. Temporarily alters neighborhood. Uncertainty of future availability of compliant landfill.
- Interim Capping Followed by Excavation and Off-Site Incineration	Preferred	Technically acceptable and implementable. Temporarily alters neighborhood. More costly than landfill, but facilities more likely to become available.
No Action	Not Preferred	Inconsistent with planning objectives.
SITE MANAGEMENT		
Grading, Revegetation, Fencing, Monitoring and Maintenance	Preferred	Grading, revegetation, and fencing required for restoration. Monitoring and maintenance required to ensure effectiveness of clean-up.
Surface Water Diversion	Not Preferred	Not applicable to site conditions.
Land Use Controls	Not Preferred	Difficult to implement.

of the feasibility study. The final evaluation of groundwater alternatives involved:

1. Recovery of the entire plume, treatment by granular activated carbon, and reinjection of the treated water;

2. Recovery of the pentachlorophenol plume, treatment by granular activated carbon, and reinjection of the treated water; and

3. Natural attenuation of the contaminants after source removal or isolation.

Recover Entire Contaminant Plume

Recovery of the entire 43,000,000 gallon contaminant plume would require a network of 97 recovery wells. The contaminated groundwater would be treated by granular activated carbon units onsite. The treated groundwater would be reinjected into the shallow zone via 41 reinjection wells. The large number of wells is required because of the low yield of the shallow zone, limiting the rate at which any single well can be operated. The cost of this alternative is estimated to be $7.7 million and would take over 20 years to complete.

Recover Pentachlorophenol Plume

This alternative would provide for the recovery of the smaller plume contaminated with pentachlorophenol. Approximately 7,000,000 gallons of contaminated groundwater would be pumped and treated by carbon adsorption. The treated water would then be reinjected into the shallow zone. The cost of this alternative is estimated to be $2.7 million, and would require five years to complete.

Natural Attenuation

Attentuation involves three processes; dilution, adsorption, and possible biodegradation. Upon the removal or isolation of the contaminated material in the former pond area, one would expect that the concentration of of contaminants in the groundwater would decrease over time. Some migration of the plume (1/2-3/4 mile) would occur during the attenuation period of 400 years.

Natural attentuation is the selected alternative for the shallow groundwater at United Creosoting. Removal or isolation of the soils in the former pond area will be necessary. When the source control remedy is completed, the contaminant loading to the groundwater will be eliminated. At this time, dilution adsorption, and biodegradation will begin to decrease the contamination in the shallow zone.

Both of the plume recovery alternatives were eliminated because of the lack of potential of the shallow zone as a groundwater resource. Because there are no identified current or potential receptors, the contaminants are not considered to pose a threat to health or the environment.

The cost of the natural attenuation is estimated to be $120,000. The capital cost is associated with plugging most of the existing monitoring wells and restoring the well areas to pre-site investigation conditions. A few wells would be left in place as part of the remedial post-closure monitoring program.

Soils Alternatives

Alternative 1 - No Action

Section 300.68(f) of the National Contingency Plan specifies that the "No Action" alternative be evaluated. The only activities associated with the "No Action" alternative would be site restoration to pre-investigation conditions and future groundwater monitoring. The restoration involves plugging most of the monitoring wells and repairing any damage to yards from well installation. Groundwater monitoring would be necessary to ensure that the groundwater objective was met.

In the absence of remedial action, the long term stabilization of the site cannot be assured. The primary threat to public health and the environment remaining under the "No Action" alternative is the potential for direct contact with contaminated subsurface soils. Site improvements involving excavation in the former pond or tank storage areas could expose persons to concentrations of contaminants that may represent a chronic health threat. Because the "No Action" alternative would not effectively mitigate threats to human health and the environment, it is eliminated.

Alternative 2 and 3 - Excavation and Onsite Disposal

Alternatives 2 and 3 involve the excavation of 84,000 cubic yards of soils contaminated with greater than 100 ppm of polynuclear aromatic hydrocarbons. These soils would be disposed of by either construction of an onsite landfill, maintained in accordance with the performance standards in the Resource Conservation and Recovery Act (RCRA). The net present worth of the onsite landfill alternative is $12 million; for the onsite incinerator, $29 million. Net present worth includes capital cost and operation and maintenance (O&M) costs. O&M costs are discounted at a rate of 10% for 30 years.

Alternative 4 - Permanent Cap and Slurry Wall

Alternative 4 involves the consolidation of all of the contaminated surface soils in the former pond area. A multi-layered cap would be built over both the pond area and the storage tank area. A slurry wall barrier would be built around the former pond area to prevent outward migration of contaminated groundwater from the pond area. The wall would be about 2 1/2

feet thick, average 35 feet deep, and tie into the aquitard beneath the shallow water bearing zone. The net present worth of this alternative is estimated to be $3.9 million. O&M activities would involve long-term inspection and cap repair, and groundwater monitoring to ensure the integrity of the slurry wall.

Alternative 5 - Temporary Cap, Future Disposal

Alternative 5 is similar to Alternative 4 in that the contaminated surface soils would be consolidated in the former pond area. However, in this alternative, a temporary, single layer cap would be placed over the consolidated soils. No slurry wall would be constructed around the pond area.

The EPA would periodically assess the availability of offsite disposal facilities permitted to handle dioxin-contaminated wastes. New, emerging technologies that may be applicable to the site would also be evaluated. When an appropriate disposal method becomes available, the contaminated soils in the pond and tank areas would be excavated and disposed. This assessment period would continue for five years. If no facilities or appropriate technologies are identified, the permanent cap and slurry wall alternative (Alternative 4), or possibly the onsite incinerator alternative (Alternative 3) would be implemented.

The cost of Alternative 5 depends upon the ultimate disposal method selected. Costs using conventional disposal methods are listed below:

Disposal Method	Cost (millions)
Permanent Cap/Slurry Wall	$4.5
Offsite Landfill	$26.0
Onsite Incineration	$31.0
Offsite Incineration	$140.0

A comparison of the effectiveness, feasibility, implementability, and cost of these alternatives is presented in Table 9.

Relocations

Permanent relocations

As noted previously, six houses were built directly above and adjacent to the former waste ponds. As part of any remedial alternative, except "No Action", these houses will have to be demolished in order to address the contaminated subsurface soils in the pond area. These relocations are necessary to remove or isolate the contaminated soil beneath the houses. This is action necessary for the protection of public health and the environment.

TABLE 9

SUMMARY OF KEY DIFFERENCES IN PREFERRED REMEDIAL ACTION ALTERNATIVES
SHALLOW GROUNDWATER
UNITED CHROMIUM COMPANY SITE

PREFERRED REMEDIAL ACTION ALTERNATIVE	TECHNICAL FEASIBILITY	ENVIRONMENTAL EFFECTIVENESS	IMPLEMENTABILITY	CAPITAL COST	MAINTENANCE/MONITORING COSTS ANNUAL	MAINTENANCE/MONITORING COSTS PRESENT WORTH	TOTAL PRESENT WORTH
Highest Contamination Plume Withdrawal with On-Site Activated Carbon Treatment and Reinjection	Utilizes conventional withdrawal and treatment methodologies. Treatment of withdrawal waters to background levels. Difficult to implement in conjunction with soils capping methods.	Removes some contaminants from site. Eventual destruction of organics during incineration of spent activated carbon. Possible future human contact with remaining contaminant plume. Some impact to neighborhood during remediation.	Requires 5 years of groundwater withdrawal to achieve background levels in pumping areas. Natural attenuation of remaining plume in 300 years. Requires long-term groundwater monitoring.	$1,500,000	$240,000	$1,200,000	$2,700,000
Containment of Waste Pond Plume by Slurry Wall	Utilizes conventional technologies. Difficult to implement in conjunction with interim capping and follow-on excavation soils methods.	Achieves site groundwater objectives. Does not disrupt residential land usage of site. However, neighborhood is permanently impacted by wastes remaining on-site. Possible future human contact.	Requires less than 6 months to construct. Natural attenuation of shallow plume in over 400 years. Requires long-term groundwater monitoring.	$790,000	$19,000	$190,000	$980,000
Source Removal and Natural Attenuation	Utilizes conventional technologies. Must be implemented in conjunction with soils method which removes or contains former waste pond area.	Achieves site groundwater objectives. Does not disrupt residential land usage of site. Possible future human contact.	Natural attenuation to background quality in over 400 years. Requires long-term groundwater monitoring.	$50,000	$5,000	$70,000	$120,000
No Action	NA	Does not accomplish site objectives. Potential for future human contact with contaminated soils and shallow groundwaters. Potential for further degradation of groundwater and surface water quality.	NA	$50,000	$5,000	$70,000	$120,000

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TABLE 9 (cont.)

SUMMARY OF KEY DIFFERENCES IN PREFERRED REMEDIAL ACTION ALTERNATIVES
SURFICIAL AND SUBSURFACE SOILS
UNITED CHROMIUM CORPORATION SITE

PREFERRED REMEDIAL ACTION ALTERNATIVE	TECHNICAL FEASIBILITY	ENVIRONMENTAL EFFECTIVENESS	IMPLEMENTABILITY	CAPITAL COST	MAINTENANCE/MONITORING COSTS ANNUAL	PRESENT WORTH	TOTAL PRESENT WORTH
Excavation with On-Site Disposal in RCRA Equivalent Landfill	Utilizes conventional technologies	Contaminated soils isolated from human contact. Removes source to meet shallow groundwater objectives. Possible temporary air releases during construction. Possible aesthetic objections. Future land use restrictions. Alters neighborhood.	Requires 1 year to implement. Requires long-term maintenance and monitoring	$11,000,000	$80,000	$1,000,000	$12,000,000
Excavation with On-Site Treatment by Incineration	Utilizes conventional technologies. Pilot studies recommended prior to full implementation	Destructive technology to remove organics. Temporary impact on neighborhood. Possible temporary air releases during soil excavation. Potential for inadvertent air releases during treatment. Removes source to achieve groundwater objectives.	Requires approximately 1 year to complete. Incinerator fuel supply available. Space for 3 incinerators available in vacant area.	$21,000,000 (Construction On-Site)	—	$8,000,000	$29,000,000
				$69,000,000 (Lease Commercial Mobile Units)	—	$8,000,000	77,000,000
Isolation of Surficial and Subsurface Soils by Infiltration Controls	Utilizes conventional technologies can be implemented in conjunction with groundwater slurry wall containment	Contaminated soils isolated from human contact. Achieves groundwater objectives. Potential for future releases due to cap erosion. Alters appearance of neighborhood. Future land use restrictions.	Requires 4-6 months to implement. Long-term maintenance and monitoring required.	$2,400,000	$50,000	$500,000	$2,900,000
Interim Capping Followed by Excavation and Off-Site Incineration Treatment of Surficial and Subsurface Soils	Utilizes conventional technologies. Depends on future availability of off-site incineration facilities.	Ultimately removes wastes from site. Interim impact on neighborhood. Possible temporary air releases during soil excavation. Destructive technology.	Cap construction requires 4-6 months to implement. Future excavation requires 6 months. Uncertain availability of future incineration capacity. Requires interim monitoring and maintenance for 5 years.	$40,000,000	$2,000	200,000	$40,000,000

TABLE 9 (cont.)

SUMMARY OF KEY DIFFERENCES IN PREFERRED REMEDIAL ACTION ALTERNATIVES
FINANCIAL AND SUBSURFACE SOILS
UNITED CHEMICAL/OLENTANGY SITE

PREFERRED REMEDIAL ACTION ALTERNATIVE	TECHNICAL FEASIBILITY	ENVIRONMENTAL EFFECTIVENESS	IMPLEMENTABILITY	CAPITAL COST	MAINTENANCE/MONITORING COSTS ANNUAL	MAINTENANCE/MONITORING COSTS PRESENT WORTH	TOTAL PRESENT WORTH
Interim Capping Followed by Excavation and Off-Site Landfill Disposal of Surficial and Subsurface Soils.	Utilizes conventional technologies. Depends on future availability of off-site landfill facilities.	Ultimately removes wastes from site. Interim impact on neighborhood. Possible temporary air releases during soil excavation.	Cap construction requires 4-6 months to implement. Future excavation requires 6 months. Uncertain availability of future landfill capacity. Requires interim monitoring and maintenance for 5 years.	$26,000,000	$52,000	$100,000	$26,000,000

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The following houses are affected by permanent relocations: 5, 6, and 7 Brewster Street and 5, 6, and 7 Columbia Street.

The homeowners and tenants residing in these houses will be provided with permanent relocation assistance through the Federal Emergency Management Agency (FEMA) in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970. It will be necessary for a governmental unit to acquire property rights in the properties in order to carry out the remedy.

Temporary relocations

Provisions have been made for the temporary relocation of residents in the subdivision during the excavation of the soils in the former pond area. The purpose of these relocations is to protect residents from possible hazards from the generation of dust and volatile organics during excavation. In the feasibility study, temporary relocations were estimated for a 6 month period for all households within 100 yards of the pond area. In actuality, the period of relocation will be defined by the time required for excavation. During the remedial design, a more definite radius of relocation could be developed by modelling the migration of volatiles released from the pond area. Temporary relocation assistance will again be provided through FEMA.

Community Relations

Public interest in United Creosoting has been high, particularly among the homeowners in the residential area onsite. Several meetings were held with the Tanglewood East Homeowner's Association during the course of the RI/FS. These meetings were held to keep the people most affected by the site up-to-date on project activities. Approximately 100 people attended these meetings.

The public notice period began on August 8, 1986. The results of the feasibility study and the proposed alternatives were presented to the Tanglewood East Homeowners' Association on August 20, 1986. This was followed by a three-week public comment period beginning on August 22 and ending on September 12, 1986. A public meeting was held to present the results of the feasibility study on Augut 28, 1986 in Conroe, Texas. Approximately 125 people attended the meeting. Most of the comments received at the meeting were from homeowners requesting a complete buy-out of the residential area. Onsite incineration, in lieu of a total subdivision buy-out, was received favorably by a few commentors at both the homeowners' association meeting and the public meeting. Responses to the comments received during the comment period are outlined in the "Community Relations Responsiveness Summary" attached to this Record of Decision.

Consistency with other Environmental Laws

The Environmental Protection Agency's policy is to select a remedial action that attains or exceeds applicable or relevant and appropriate Federal environmental and public health requirements. Other Federal criteria and advisories and State standards may be used, with adjustments for site-specific circumstances. In the absence of the cleanup standards defined by regulations or health advisories, a risk assessment may be used. This assessment should derive the concentration of contaminants which would represent a 10^{-6} cancer risk.

Standards have not been established for PAHs and PCP in soils. A health based standard for 2,3,7,8 - tetradioxin (TCDD) of 1.0 ppb in residential soils has been established by the Centers for Disease Control (CDC) in Atlanta. Guidelines for other isomers of dioxin and for PAHs may be developed by comparing the toxicity of 2,3,7,8 - TCDD to the toxicity of these other contaminants found in the site soils. This method was developed by the EPA Carcinogen Assessment Group in Washington, D.C.

Based on this method and a review of the data by CDC, the presence of dioxins, dibenzofurans, and PCP, United Creosoting does not pose a health threat. However, the PAHs found may present a chronic threat. Eliminating the direct contact with these soils is consistent with the intent of Superfund to meet applicable and/or relevant Federal regulations.

The Resource Conservation and Recovery Act (RCRA) and the Uniform Relocation Act of 1970 also have an impact on the selected remedial action. RCRA defines the performance standards to be met by methods used for the disposal of hazardous wastes. Any offsite disposal facility used for the disposal of the contaminated materials will have to be fully permitted under RCRA (as opposed to having interim status) and certified for dioxin contaminated wastes (Federal Register, Vol. 50, No. 9, January 14, 1985, pp. 1978-2006). These facilities must also be in compliance with the Superfund Offsite Disposal Policy (Federal Register, Vol. 50, No. 214, November 5, 1985, pp. 45933-45937).

As stated previously, all relocations and property aquisitions would be done in accordance with the Uniform Relocation Act of 1970. This will ensure that all residents affected will be treated equally, and that the security and safety of the subdivision will be maintained.

Recommended Alternative

Section 300.68(i) of the NCP states that "the appropriate extent of remedy shall be determined by the lead agency's selection of a cost effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and the environment." To this end, Alternative 5 in combination with natural attenuation of the shallow groundwater plume is the recommended remedial action for the United Creosoting site. The components of this alternative are as follows:

- Purchase and demolish six houses built directly above and adjacent to the former pond area;
- Permanently relocate the families currently in those houses;
- Consolidate the contaminated surface soils onto the former pond areas;
- Construct a temporary cap over the pond area;
- Periodically assess the availabilty of offsite facilities permitted for the disposal of dioxin-contaminated wastes and applicable emerging innovative technologies.
- Excavate and dispose of the soils in the former pond area and soils contaminated with greater than 100 ppm of PAHs in the former stoarage tank area by the selected disposal method.
- Backfill and provide final cover in the pond and storage tank areas.
- Groundwater attenuation through natural processes of dilution and adsorption.

The areas of soil contamination to be addressed by the recommended alternative are illustrated in Figure 10. The rationale for the selection of Alternative 3 is outlined below.

The selected alternative (consolidation, temporary capping, and future disposal) is currently the most acceptable alternative given the combination of site conditions and contaminants at United Creosoting. Permanent onsite remedies (alternatives 2 and 4) represent long-term storage of the waste and is less acceptable environmentally. Perpetual maintenance of the surface cover and groundwater monitoring would be required in order to ensure the integrity of the closure system.

Onsite incineration (Alternative 3) would eliminate the potential problems discussed above by destroying the contaminants over a relatively short period of time. However, concerns regarding the timeliness and safety of this remedy were expressed during the comment period. EPA believes that a safe and environmentally sound incinerator can be designed, constructed, and operated at this site. However, projected costs are somewhat higher than the low range of the selected alternative. In addition, EPA would prefer to have the consensus of the community and State and local government before applying this technology in a residential setting.

Currently, dioxin-certified transportable units are not available. EPA believes that the availability of these units will increase in the near future and that these units can be designed, built, and operated without adverse effects to public health or the environment. However, until enough of a track record can be developed to prove this to the public, it may be more prudent to operate these units in more rural areas.

Alternative 5 also offers interim protection until offsite disposal facilities fulfill the administrative and technical requirements for the disposal of dioxin contaminated wastes. The alternative may also offer protection until an applicable and reliable innovative technology becomes available. By removing the contaminated surface soils from the residential area immediately, future impacts to the subdivision will be minimized. This alternative also provides the opportunity to remove the waste from a densely populated area.

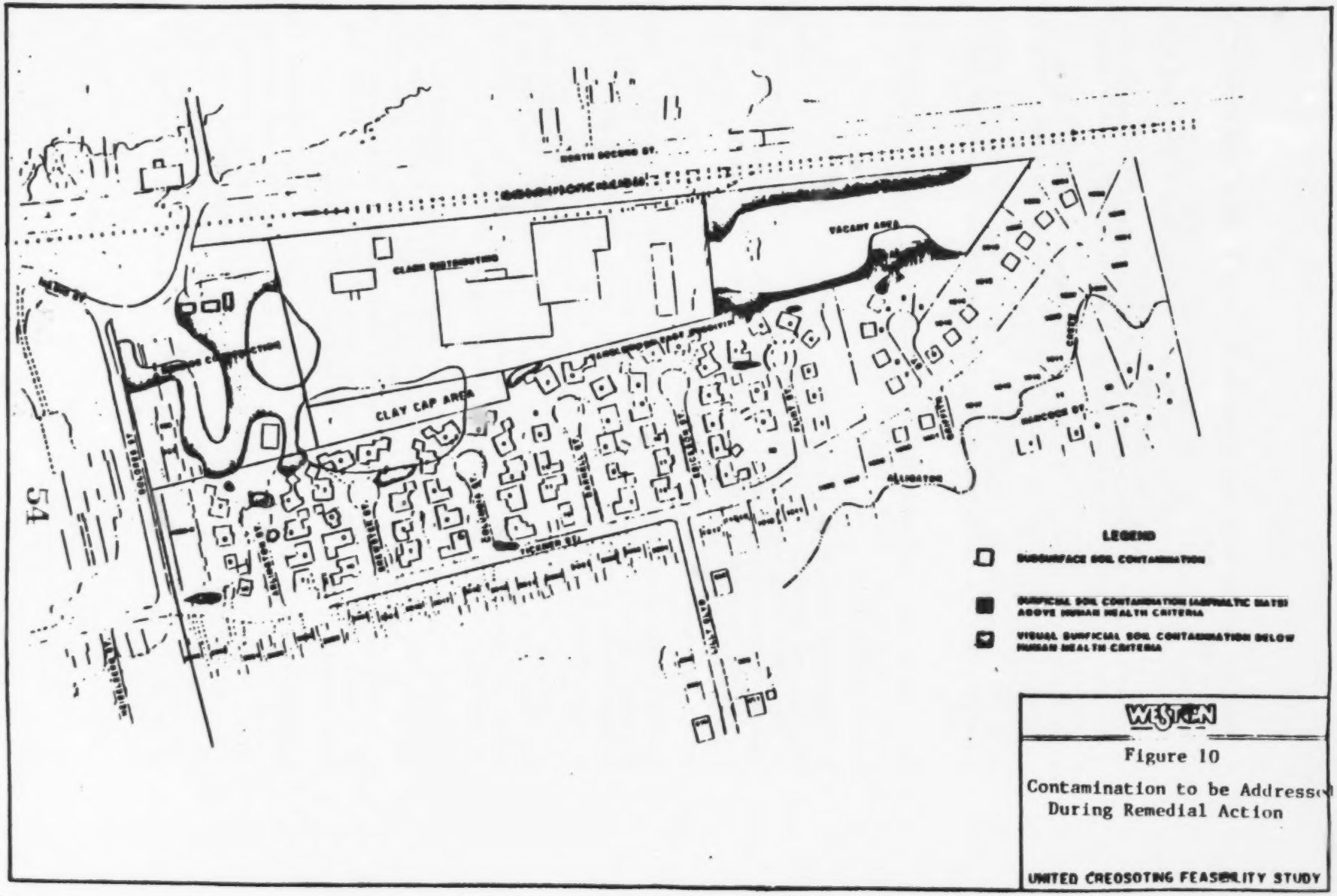

Figure 10

Contamination to be Addressed During Remedial Action

UNITED CREOSOTING FEASIBILITY STUDY

At the end of the interim period, a second Record of Decision will be required to document the selection of the permanent remedy.

Cost of Selected Alternative

The estimated capital cost of Alternative 5 ranges from $4.5 million for future offsite land disposal to $140 million for offsite incineration. Costs for emerging innovative technologies may be difficult to asses at the present time. Factors such as site preparation, material and energy requirements, and disposal requirements must be evaluated before a cost estimate can be developed.

Operation and maintenance (O&M) costs are estimated to be $43,000 per year during the interim closire period. O&M costs during the post-closure period are estimated to be $6,000 for groundwater monitoring. The post-closure cost will increase to $50,000 if no offsite facilities become available and a permanent cap and slurry wall are built after the interim closure period.

Operation and Maintence

Operation and maintenance (O&M) activities required during the interim closure period will include inspection and repair of the temporary cap and landscaping in the cap area. O&M activities during the post-closure period include routine groundwater monitoring to ensure that natural attenuation is occurring after excavation of the waste. If a permanent cap and slurry wall are installed at the end of the closure period, post-closure O&M activities will also include periodic cap inspections, repair and landscaping.

The Trust Fund is available for O&M costs for a period of up to one year after completion of construction of the remedy. The State of Texas will be responsible for the inspections and monitoring for a period of at least 30 years after completion of the construction. If significant increases in contamination are detected during the post-closure period, additional corrective measures will be evaluated.

Schedule

The schedule for the remedial design and construction of the selected remedy for United Creosoting is currently dependent upon reauthorization of Superfund. The remedial design will begin as soon as funding becomes available, either through reauthorization or a continuing resolution. The design phase will take an estimated 12 to 18 months to complete.

Consolidation of the surface soils and construction of the temporary cap will begin as soon as possible after completion of the design. This phase of construction is estimated to take 8 to 10 months to complete. The excavation and offsite disposal phase is estimated to take 12 months to complete. However, this estimate is dependent upon the disposal method selected.

Coordination with the Federal Emergency Management Agency to conduct the permanent relocation activities will begin in the Fall 1986. Contingency monies have been made available to the Region to begin the relocation activities. It is estimated that these activities will take at least one year to complete.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Agency for Toxic Substances
and Disease Registry

Memorandum

Date January 17, 1986

From Acting Director
Office of Health Assessment

Subject Health Assessment: United Creosote Site
Conroe, Texas

To Mr. Carl R. Hickam
Public Health Advisor
EPA Region VI

EXECUTIVE SUMMARY

The United Creosote Site contains residual polynuclear aromatic hydrocarbons (PAH's) and pentachlorophenol from the former wood-preserving activities on the site. These residues are primarily subsurface; however, there are isolated "tar mats" located in various residential yards. The Environmental Protection Agency (EPA), Region VI, requested an acceptable cleanup level for these residues. During an October 10, 1985 conference call with Region VI, a value of 100 ppm for total PAH in surficial residential soil was suggested as a value that is unlikely to result in a public health risk.

STATEMENT OF PROBLEM

After Region VI reviewed the July 31, 1985 Superfund Implementation Group memorandum evaluating the potential health hazard presented by the chemical contamination, they requested assistance in developing a design value for the planned cleanup of the site.

DOCUMENTS REVIEWED

1. Memorandum from Don Williams, EPA Region VI, October 10, 1985.
2. Memorandum from Georgi A. Jones, Superfund Implementation Group, July 31, 1985.
3. ATSDR United Creosote site file.

CONTAMINANTS AND PATHWAYS

The principle contaminants at this site are creosote and pentachlorophenol. The exposure pathways are direct contact with contaminated soils and creosote residues, and the consumption of contaminated groundwater. The highest levels of creosote contamination reported are located in "tar mats" at various locations near the site, both on and beneath the surface

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of the soil. Except for the few reportedly isolated "tar mats," the predominate contamination at the site is subsurface. Without substantial effort on the part of the human population, this subsurface contamination presents little opportunity for contact. The local groundwater is contaminated with both pentachlorophenol and the more soluble PAH's; however, this water, reportedly, is not currently being used for domestic purposes.

DISCUSSION

In a published article[1], the Centers for Disease Control (CDC) derived an action level at which to limit human exposure for 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8,-TCDD) contaminated residential soil. This derived value was based upon extrapolations from animal toxicity experiments (including carcinogenicity and reproductive effects) to possible human health effects in order to estimate a reasonable level of risk for 2,3,7,8-TCDD. A 10^{-6} excess lifetime risk was used in the development of this TCDD soil level.

The Environmental Protection Agency's Carcinogen Assessment Group[2] has derived a relative potency index for more than 50 chemicals. The order of magnitude potency index for 2,3,7,8-TCDD is eight, while that for benzo(a)pyrene is only three. Thus, 2,3,7,8-TCDD is considered to be five orders of magnitude more potent as a carcinogen than benzo(a)pyrene. Using only this order of magnitude difference in potency between the two chemicals and the CDC-derived residential soil action level, gives 100,000 ppb of benzo(a)pyrene equivalent to 1 ppb of 2,3,7,8-TCDD in soil.

In the model used to derive the 2,3,7,8-TCDD soil value, the assumption concerning the amount of soil ingested has been shown to be high. A recent unpublished study by CDC has shown the amount of soil ingested by children of the soil-eating age ranges from 0.1 to 1 gram per day (S. Binder personal communication). Thus, the model estimate for soil ingestion during the period of minimum hygiene is excessive by at least an order of magnitude. Since the other soil ingestion rates in the model are also estimates, there is a good likelihood that they are also in error, possibly by more than an order of magnitude. Thus, the model very likely overestimates the total lifetime soil ingestion exposure by at least one order of magnitude.

In addition, the model contains a factor to account for the environmental degradation of the specific chemical. The factor for 2,3,7,8-TCDD assumed a 12-year half-life in soil. While the numerous PAH's have a range of half-life values in surface soil, which will be dependent upon the specific soil and climatological conditions encountered, even the maximum half-life for the most degradation-resistant compound is less than the value assigned for 2,3,7,8-TCDD in the model. Even with a six year half-life, a persons lifetime exposure would be substantially reduced when compared to that estimated with the longer half-life used in the TCDD risk assessment.

Thus, considering only these two areas for modifications to the soil exposure model used to develop the 2,3,7,8,-TCDD risk assessment, it can be seen that a residue of 100 ppm of PAH's in soil is not likely to present a significant human health hazard.

In addition, when considering the significance of contamination at the site, the facts that all PAH's are neither carcinogenic nor (for those suspected carcinogens) as potent as benzo(a)pyrene must be a part of the evaluation. As a first approximation of a site, it may be valid to use the total PAH concentration to determine an estimate of the significance of the contamination. However, when determining cleanup action, the use of isomers and compounds, which are truly hazardous, would be most appropriate when that information is available.

The application of the model to obtain the 100 ppm cleanup concentration has assumed that all PAH's are as potent as benzo(a)pyrene, generally considered to be the most potent carcinogen of the PAH's. This is, in fact, not valid, as those PAH compounds which are considered to be suspected or probable carcinogens, comprise less than half of the total PAH concentration at any site. In addition, many of these compounds designated as suspected or probable carcinogens, are much less potent than benso(a)pyrene".

The Environmental Protection Agency recently released a Draft Health Advisories for pentachlorophenol in drinking water. The life-time value for adults in this document is 1050 ug/l. This value is substantially greater than the 21 ug/l discussed for use in evaluating the groundwater contamination at this site. Based upon this new evaluation for pentachlorophenol in drinking water, the need for and extent of groundwater renovation for this site should be reconsidered.

RECOMMENDATIONS

Polynuclear Aromatic Hydrocarbon (PAH's) concentrations in residential soil less than 100 ppm should present no significant acute or chronic health threat to human health through any normal route of exposure.

The need for and extent of groundwater renovation should be reconsidered based upon the recent EPA Health Advisory for pentachlorophenol.

We hope this information is useful to you.

(for) Stephen Margolis, Ph.D.

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1. Kimbrough, R.D., Falk, H., Stehr, P., and Fries, G., "Health Implications of 2,3,7,8-tetrachlorodibenzodioxin (TCDD) Contamination of Residential Soil," J. Tox. & Envir. Health, 14 47-93, 1984.

2. EPA, "Health Assessment Document for Epichlorohydrin, Final Report," EPA-600/8-83-032F, pp. 7-62, 1984.

3. "Evaluation of the Carcinogenic Risk of Chemicals to Humans, Polynuclear Aromatic Compounds, Part 1, Chemical, Environmental and Experimental Data," IRAC Monographs, Volume 32, International Agency for Research on Cancer, IRAC, Lyon, France, 1983.

4. EPA, Office of Drinking Water, Criteria and Standards Division, Draft Health Advisory, September 1985.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

United Creosoting
Conroe, Texas

Responsiveness Summary

This Community Relations Responsiveness Summary is divided into the following sections:

Section I. Overview. This section discusses EPA's alternatives for remedial action.

Section II. Background of Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during remedial planning activities at the United Creosoting site.

Section III. Summary of Comments Received during the Public Comment Period. Comments are categorized by topics and EPA's responses are provided.

I. OVERVIEW

At the time of the public comment period, EPA announced several possible alternatives for corrective action at the United Creosoting site:

No Action - No action would be taken to reduce the potential site hazards. The groundwater would be monitored to track the movement of the pentachlorophenol (PCP) plume. This action would cost an estimated $120,000.

Excavation and Onsite Landfill - More than 84,000 cubic yards of comtaminated soil would be excavated and placed in an above-ground landfill constructed on the site. The landfill would meet all State and EPA requirements. This alternative would prevent direct contact with the highly contaminated soils and remove the source of the groundwater contamination. This action would take approximately one year to implement and cost an estimated $12 million.

Onsite Incineration - The contaminated soil described above would be excavated and destroyed by an incinerator constructed on the southern end of the site. This incinerator would be dismantled and removed from the site after all of the contaminated wastes from the United Creosoting site have been destroyed. This action would take 2-3 years to complete and would cost an estimated $29 million.

Cap and Slurry Wall - All of the contaminated surface soils would be consolidated into the former pond area. A slurry wall (or underground barrier) would be constructed around the former pond and storage tank areas. This area would then be covered with a multilayer cap. This alternative prevents direct contact with the highly contaminated soils and isolates the source of the groundwater contamination. Approximately one year is required to complete this remedial action that would cost an estimated $3.9 million.

Temporary Cap and Future Removal - A temporary cap would be constructed over the former pond and storage tank areas and a fence would be built around the capped area. The temporary cap would prevent direct contact with the highly contaminated soils and reduce the potential for further groundwater contamination. Currently, no facilities are permitted to incinerate or landfill wastes containing cholorinated dioxins; therefore, EPA would periodically assess the availability of offsite incineration capacity or offsite landfill capacity.

If no offsite facility becomes available within five years, EPA would construct a slurry wall and replace the temporary cap with a permanent cap. Estimated costs for the permanent cap alternative are $4.5 million; offsite incineration, $140 million; and offsite landfill, $26 million.

Recovery of the PCP Plume - Seven million gallons of contaminated groundwater would be pumped to the surface and treated by carbon adsorption and reinjected into the aquifer. This action would take an estimated five years and $2.7 million to complete.

Based upon the results of the Remedial Investigation and the analyses performed in the Feasibility Study, EPA proposed the temporary cap and future removal as the corrective action for this site. This alternative as well as all other alternatives for source control involve permanent and/or temporary relocation of businesses and affected residents. Natural attenuation was proposed for the shallow groundwater.

Judging from the comments received during the public comment period, the residents want a total buyout and relocation of all of the residents in the subdivision. As a second choice, the residents expressed a desire that EPA destroy or remove the contamination quickly and give the neighborhood a "clean bill of health".

II. BACKGROUND ON COMMUNITY INVOLVEMENT

During the 1940's, when United Creosoting began operation, the site was relatively isolated from any significant population concentrations or urban development. By the time operations ceased in 1972, some development had occurred in the general area. The property remained essentially dormant until redevelopment of the area began in 1977.

Residential property owners were basically unaware of the previous land usage and the potential hazards until the site was added to the National Priorities List in September 1983. An initial property owners' meeting was held on September 6, 1983, to discuss the Superfund program and current site conditions. The vast majority of those in attendance demonstrated a very high level of concern.

Another meeting was held on December 8, 1983, to explain the immediate response action planned for the site. This action included capping a highly contaminated area and constructing drainage structures to improve drainage and divert runoff away from the residential area.

In February 1984, representatives from the Centers for Disease Control in Atlanta, the Montgomery County Health Department, and the Texas Department of Health met with the area residents to discuss the health oriented questions. Most of the concern centered around the long-term effects of continuous exposure to PCP.

The results of the remedial investigation were mailed to the area repositories and presented to area residents at a meeting in January 1986. The major concerns were health effects and the economic stability of the neighborhood.

III. SUMMARY OF PUBLIC COMMENT

The press release announcing the public comment period and public meeting was issued on August 14, 1986. The comment period began on August 22 and ended on September 12, 1986. A meeting was held with the area residents on August 20 to explain the results of the remedial investigation and to outline the alternatives presented in the Feasibility Study. Seventy-four persons registered at this meeting and 17 made oral statements or asked questions. The public meeting was held August 28, 1986, in the Travis Junior High School auditorium in Conroe, Texas. Seventy-eight people registered at the meeting and 21 made oral statements or asked questions. Written comments or questions were received from an additional seven citizens during the public comment period. A petition signed by 78 homeowners was submitted to EPA requesting that their homes be purchased and the families relocated.

During the public comment period, there were comments/questions regarding the following:

Comment #1: Why is a cleanup necessary if no health threat is posed at the site?

Response: Since EPA cannot be assured that the contamination will remain buried, remedial action is necessary to mitigate the future threats which may be posed by future excavation in the pond area.

Comment #2: Has EPA considered the impact on the deeper aquifers in recommending natural attenuation for the shallow water bearing zone?

Response: Yes. EPA believes that the clay layer separating the 25-foot sand and the 85-foot water bearing zone is an adequate barrier to vertical migration of the contaminants from the site and that the lower zones will not be impacted from the site.

Comment #3: Wouldn't it be easier to clean up the site without the houses in the way?

Response: In the former pond area, yes. This is why the six houses over the pond area must be demolished. The surface soils addressed as part of the remedial action, are found in open areas. No demolition of any structure is necessary for access to these soils.

Comment #4: Wouldn't it be cheaper to simply cover the contaminated area?

Response: Yes. This alternative was presented as the "cap and slurry wall" alternative. While this alternative is cheaper than others considered, it would require perpetual operation and maintenance to ensure that the contamination remains in place.

Comment #5: Wouldn't it be more cost-effective to buy out the entire subdivision?

Response: No. The cost of buying all of the homes would have to be added to the cost of the selected remedy. EPA could not buy the houses and then not implement a remedy to address the contaminated soils at the site.

Comment: #6: Are realtors and financial institutions liable for damages by handling the properties in the Tanglewood East Subdivision.

Response:: No.

Comment #7: Will excavation have any impacts on air quality?

Response: The emission of volatile compounds is likely during excavation. However, provisions to ensure that the air pollutants aren't a problem will be developed during the design of the remedy. Possible methods to minimize emissions include temporary covers over the work area, sprays to keep particulates down, and controlling the rate of excavation. Continuous air monitoring will allow EPA to adjust to changing air quality condition during excavation.

Comment #8: Does EPA ever get involved in recovering losses or joining in lawsuits with homeowners?

Response: EPA does file lawsuits against responsible parties for the costs incurred from the Trust Fund. EPA does not join in lawsuits where the recovery of Fund monies is not involved.

Comment #9: From which houses were vacuum cleaner samples taken?

Response: During the 1983 response action, samples were taken from #5 and #6 Brewster, #6 and #7 Columbia, and #10 Darnell. These homes were selected because they would have been most affected by the open area of the former pond.

Comment #10: Are creosote compounds in the water supply of the subdivision?

Response: No. The subdivision uses the city water supply, which has not been impacted by United Creosoting.

Comment #11: If EPA files a lawsuit for cost recovery, will EPA get paid first, or will the homeowners get paid first?

Response: Payment or satisfaction of a judgment depends upon: 1) when the judgment is obtained and 2) when enforcement of the judgment occurs. Individual lawsuits will vary in length. The EPA has not filed any lawsuits against responsible parties at this time.

Comment #12: One commentor offerred to buy all of the houses if given the remedial action contract. He would then clean up the site with biodegradation.

Response: EPA is prohibited by the Federal procurement regulations from entering into such an agreement without competitively bidding the project. EPA also does not believe that the acquisition of all of the houses is necessary for protection of public health and the environment. Therefore, purchasing the houses would not be funded.

Comment #13: Do the residents in the subdivision have a say in what alternative is chosen?

Response: Yes. All comments received from the public are reviewed, evaluated, and taken into consideration prior to the selection of a remedy.

Comment #14: Why are there no facilities that will accept dioxins?

Response: No facilities have yet obtained the necessary permits to handle dioxin contaminated material. Because of the toxicity of one isomer of dioxin, 2,3,7,8, - tetradioxin (a compound found at United Creosoting) special precautions were required by law for the handling of all dioxins. Commercial facilities have not yet modified their operations to be compliant with the new procedures.

Comment #15: If an incinerator were brought onsite, what impact would the emissions have on air quality?

Response: None that would have an adverse effect on public health or the environment. The operation of the incinerator would have to conform with the performance standards in the Resource Conservation and Recovery Act for dioxin certified incinerators as well as state and federal clean air laws. These standards were developed to protect public health and the environment.

Comment #16: Is temporary relocation voluntary?

Response: Yes, it is voluntary.

Comment #17: Several people commented that creosote odors are evident near the site in the morning.

Response: This may be true, but it is unlikely that the odors are being generated from United Creosoting. Routine air monitoring done during the remedial investigation did not show any air quality

Response: This may be true, but it is unlikely that the odors are being generated from United Creosoting. Routine air monitoring done during the remedial investigation did not show any air quality problems from the site. It may be possible that the odors are being generated by another wood preserving plant currently operating in Conroe.

Comment: #18: What risks would people in close proximity to an onsite incinerator be exposed to?

Response: Operation of an incinerator should not pose a risk to anyone living or working near the site. However, EPA recognizes the current site uses and would include additional safety precautions in the incinerator design.

Comment #19: Who at EPA will select the remedy for United Creosoting?

Response: The Regional Administrator, in consultation with the Assistant Administrator, Office of Solid Waste and Emergency Response in Washington, will select the remedy.

Comment #20: Why weren't the potential problems at this site publicized back in 1980 when it was discovered, or require that further land sales be deferred?

Response: Neither EPA nor the Texas Department of Water Resources (TDWR) had the authority to stop the developers from conducting business. A full assessment of potential hazards was not available at the time TDWR warned owners not to develop.

Comment #21: How long will it take to get started on the work on this site?

Response: As soon as Superfund is reauthorized, the design of the remedy can begin. This should take 12 to 18 months. Construction of the remedy should begin 6 to 9 months after the completion of the design. The time required to complete the onsite incineration alternative is estimated to be 24 to 36 months.

Comment #22: If a commercial facility does not become available, will EPA review the problem for the public?

Response: Yes. In the event that the temporary cap may become a permanent cap, EPA would hold a meeting to discuss this alternative.

Comment #23: How accurate is the estimate of the location of the former pond area?

Response: EPA believes that it is very accurate based on the results of the ground penetrating radar, soil borings, and the historical aerial photographs.

Comment #24: Is it safe to plant gardens in the subdivision and eat the vegetables from these gardens?

Response: The Centers for Disease Control has indicated to EPA that eating vegetables grown in the subdivision should not pose a health threat.

The uptake of creosote and pentachlorophenol in plants is minimal. Therefore, no adverse exposure to these compounds should occur.

Comment #25: Is there a risk for people digging their yards?

Response: Shallow digging (1 to 2 feet) anywhere in the subdivision will not pose a risk. Deeper (5 to 6 feet deep) excavations over most of the subdivison would not pose a risk. Deep excavation in the former pond area may expose soils which could represent a long-term health risk.

Comment #26: How many caps and slurry walls have failed over time?

Response: EPA does not have a specific number.

Comment #27: Will the subdivision ever get a clean "bill of health"?

Response: After review of the Remedial Investigation report, the Centers for Disease Control has concluded that there is no current or long-term health risk to residents with no contact to buried contaminants. The clean up approach selected for buried contaminants will remove the risk for contact with buried materials. The procedure for removing the site from the National Priorities List will document that any long-term health threat has been mitigated.

Comment #28: Will restrictions on building swimming pools be placed on homes in the subdivision?

Response: No. Excavations in areas away from the former pond area will not present an immediate or long-term threat. Upon completion of the remedy, excavation anywhere in the subdivision will be safe.

Comment #29: What kind of site security will be provided during the temporary relocations?

Response: The specific type of site security needed will be developed during the remedial design by the Federal Emergency Management Agency.

Comment #30: Who were the developers of the Tanglewood East Subdivision?

Response: The developer of record is a company named Charles-Thomas, Inc.

Comment #31: Have the ponds moved since the plant began operating?

Response: No. Based on the historical aerial photographs and the ground-penetrating radar survey performed during the remedial investigation, the pond areas have not moved. Migration of pond material has occurred via the shallow groundwater, but the ponds will not migrate.

Comment #32: Where were the soils taken that were removed from the site in July 1986?

Response: These soils, generated during the remedial investigation, were taken to a hazardous waste landfill in Carlyss, Louisiana. These wastes were non-dioxin contaminated materials. Approximately 50 drums of dioxin contaminated materials remain onsite.

Comment #33: If a slurry wall was installed around the entire subdivision, would EPA be justified in buying-out all of the homes?

Response: No. None of the remedial alternatives for the groundwater would require permanent relocations.

Comment #34: If dioxins are scattered throughout the neighborhood, why isn't the entire subdivision addressed as part of the remedy?

Response: The concentrations of dioxins found in soil samples taken from the residential subdivision were not high enough to pose a long-term health threat. Therefore, the dioxins in the residential soils are not addressed as part of the remedy.

Comment #35: Why won't EPA buy all of the houses in the Tanglewood East Subdivision as part of the remedy?

Response: According to the National Contingency Plan (40 CFR 300.70e), permanent relocations may be provided where it is determined that human health is in danger. The purchase of all of the houses in the subdivision is not necessary for the protection of public health and the environment. Based on the resolution of the remedial investigation/feasibility study, purchase of only six houses in the former pond area is necessary for implementation of the selected remedy. The remaining properties in the subdivision are not subject to short or long-term health risk.

Comment #36: Why wasn't biodegradation proposed as a remedial alternative?

Response: Biodegradation as a remedial technology was eliminated because of site-specific considerations. Questions regarding the effects of soil type, the effects of chlorinated dioxin, and types of emissions generated during biotreatment are very site-specific. In an effort to answer these questions, biotreatment is being studied in the Superfund Innovative Technologies Evaluation program. Because of the presence of dioxins at the site, certification for the disposal of dioxin-contaminated materials may be required.

Bioreactors were eliminated primarily due to engineering considerations. Clay soils would be very difficult to handle in the mixing basin and to de-water upon completion of the treatment. Clays may also pose a problem by inhibiting biodegradation via adsorption. Well dispensed clays would provide a tremendous surface area for adsorption of the contaminants. These contaminants may not be available to the microbes for degradation.

Two other technical issues were considered in screening out biodegradation. First, research from laboratory scale studies suggests that the presence of chlorinated dioxins may inhibit biodegradation, extending the time required to complete the remedy. Second, significant questions concerning the types and quantities of emissions from both landfarm and bioreactors have not been answered. Those emissions are particularly significant considering the proximity of the subdivision to the treatment area.

Comment #37: Several commentors were concerned that their homeowner's insurance policies would be cancelled during the temporary relocation period.

Response: A homeowner's insurance policy would only be subject to cancellation during temporary relocation if the home were deemed "vacant" that is, if substantially all of the furnishings were removed. If a homeowner simply removes those personnel items necessary to relocate temporarily, the home would be considered "unoccupied" and the insurance policy would remain in effect.

Comment #38: If additional homeowner's insurance is required during the temporary relocation period, who pays for this?

Response: It is the homeowner's responsibility to pay for any additional insurance coverage.

Comment #39: Is the homeowner's right to sue responsible parties for economic damages overidden by EPA?

Response: No. The homeowners can file suit against the responsibile parties in an effort to recover damages which they have standing to assert.

Comment #40: What will prevent EPA from implementing the interim remedy and walking away from the site?

Response: The Record of Decision, signed by the Regional Administrator, commits EPA to complete the selected remedy. Secondly, EPA is committed to adequately protect public health and the environment from long term risks. The interim cap will not provide this type of protection.

Attachment A

Community Relations Activities

Community relations activities conducted at the United Creosoting site to date include the following:

- o An initial meeting was held by the Texas Department of Water Resources (now the TWC) for the property owners and residents of the Tanglewood East Subdivision on September 6, 1983.
- o Similar meetings to explain the immediate response action were held December 8, 1983, and February 28, 1984.
- o The Community Relations Plan was finalized in May 1984 establishing information repositories at the Conroe City Hall, Montgomery County Library, University of Houston Library, Rice University Foundren Library, and the Houston - Galveston Area Council offices.
- o The Texas Water Commission held a meeting on January 27, 1986, in Conroe to provide area residents the results of the remedial investigation.
- o The Remedial Investigation report was made available to area repositories on March 11, 1986.
- o On August 13, 1986, EPA and TWC representative met individually with the residents and property owners most immediately impacted by the proposed remedy.
- o The Feasibility Study was released for public review and comment on August 14, 1986.
- o EPA, TWC, CDC, and Federal Emergency Management Agency representatives held a meeting with the area property owners and residents on August 20, 1986, at the St. Marks Lutheran Church in Conroe. 74 people attended.
- o EPA representatives met with six area residents on August 26 in Conroe to discuss the aspects of incineration.
- o EPA held a public meeting at Travis Junior High School in Conroe to describe the RI/FS reports and to respond to citizens' questions. 78 people registered at the public meeting on August 28, 1986.
- o The public comment period closed September 12, 1986.
- o The transcripts of the August 20 and 28 meetings were sent to the area repositories on September 19, 1986.
- o This Responsiveness Summary was provided to all speakers at the public meetings on August 20 and 28 and to all citizens who commented during the public comment period.